

1-15 MAY, 2015

DownToEarth

SCIENCE AND ENVIRONMENT FORTNIGHTLY

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23rd

Anniversary Issue

Shadow over Taj

The threat of pollution returns

NEW RELEASE

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BOOK 



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THE EARTH FOR YOU

DOWN TO EARTH is a product of our passion for change. But it would not have made it to its 23rd anniversary without your continued commitment. Our desire is to bring you news and perspectives on the state of the environment and explain why it needs attention. It is clear to us that as we produce each issue—this is 552nd edition—the struggle for a green, but prosperous, world is getting more intense, contested and difficult. It is also clear that if we do not have independent and credible sources of information, we cannot even begin to move towards resolution.



*Anniversary
Issue*

This is your magazine, literally. *Down To Earth's* finances are straightforward. We continue to print because you continue to read us; send us annual subscriptions. In this issue, we also bring you a new-look *Gobar Times*. We hope you like it, as this is our educational product, available only to you—our subscribers.

We believe we have a huge unfinished agenda. There is no doubt that the world (and India) has evolved since our first edition in May 1992. Environmental issues are now part of the mainstream. We read about pollution in our cities in newspapers; governments swear to clean up rivers and remove garbage from our streets. But in this change, our role is even more acute: to examine proposals; to critique actions and to suggest ways ahead. Our best work is to learn about who is doing what to make a visible difference. Our best day is when we hear that our effort to bring the “good news” has been recognised. Someone, somewhere has learnt from it, replicated it.

In this season of despair—when unseasonal rain, freak storms, hailstorms and the prospect of a failing monsoon have robbed farmers of hope—we make a renewed vow. We will bring you good and bad news from farms, laboratories, factories and homes. We will continue to show the way ahead in building a fair, secure, liveable and healthy world. It is our duty to hope. It is our duty to you. ■

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ON THE WEB



WHAT'S HOT

SPECIAL COVERAGE

Amending the Montreal Protocol

The HFC Management Workshop in Bangkok was aimed at building consensus over shift from hydrofluorocarbons (HFCs) to gases with low global warming potential. While there was some convergence over technological options, nations with warmer climate showed stiff resistance



SPECIAL FEATURE

Home alone in Goa



Goa is a state with the highest proportion of locked houses in India. Though many states in the country are witnessing the real estate boom, for some, it is Goa's charm that tempts them to build

homes even if they can't live in them and for others it is an act of affluence. *Down To Earth* analysed data from the latest Census and spoke to some house owners to know more reasons behind the trend

BLOG

Plan water-sensitive designs for cities

says Sushmita Sengupta from the World Water Forum in South Korea

POPULAR

On web

Raining troubles: can India afford to ignore the Western Disturbances?

On Facebook

World's last male northern white rhino placed under armed guard

On Twitter

What we all should know about #SaveTheInternet

VIDEO

What is National Air Quality Index

Air pollution levels have been classified in six bands with simple descriptions to help people understand. A CSE researcher explains more



www.downtoearth.org.in

Readers maketh a magazine

Since our inception, we have received overwhelming letters from our readers showing their love and support. But there were some who also criticised and cautioned us. Their feedback was critical for our growth. On our 23rd anniversary, we present 23 such letters. Sorry, it's 22; one is our first letter wishing us good luck. We just couldn't resist republishing it

OUR FIRST LETTER

1 **Bridge the gap** (MAY 16-31, 1992)

It is a great idea to bring out a fortnightly news magazine dealing with science, technology, environment and development. It should go a long way towards creating public opinion in favour of environmental protection.

P N BHAGWATI
FORMER CHIEF JUSTICE OF INDIA
NEW DELHI



2 **Have you got what it takes?**

MAY 16-31, 1992

I want to sound a note of caution for your new publication. It is easy for newspapers and magazines to promote another journal. They can absorb the initial losses and attract advertisements quickly. But a new entrant without the support of a newspaper is likely to face many challenges. I hope you have taken these aspects into consideration.

N KRISHNASWAMY
SECRETARY
GANDHI PEACE FOUNDATION
NEW DELHI

3 **Involve your readers**

OCTOBER 1-15, 1992

To make the magazine more interactive, you could feature stories that encourage readers to undertake conservation and other eco-friendly projects at home.

ROOPA DWAJAN
BANGALORE

4 **Strong reaction**

OCTOBER 16-31, 1992

I find the attitude of *Down To Earth* to be rather reactionary, especially in its support for age-old, primitive and traditional environment

practices. The magazine seems to blindly brand every development project as destructive to ecosystems.

INDRA KUMAR SHARMA
JODHPUR

5 **Shit matters**

NOVEMBER 16-30, 1992

I am disturbed at the passive approach *Down To Earth* has taken on the implications of open defecation ("Toilet trouble", September 16-30, 1992). The article should have questioned the Delhi Development Authority's responsibility to maintain



public toilets and factored in the efforts of local communities in improving sanitation in their areas.

P D MALGAVKAR
PUNE

6 **Don't forget tourism**

JANUARY 1-15, 1993

Your magazine

should include tourism as its subject as it has wide socio-economic implications on the environment.

RANJIT HENRY
MADRAS

7 Language barrier

MAY 16-31, 1993

We are a federation of voluntary agencies working in rural areas and are not well-versed with English, so it is not useful for us to subscribe to *Down To Earth*. Your magazine should be published in Hindi too to reach people at the grassroots level.

SURYAKANT PARIKH
SECRETARY, GUJARAT RAJYA
GRAM VIKAS SANGH
AHMEDABAD

8 Why only politics?

JUNE 16-30, 1993

In the future issues of *Down To Earth*, I would like to see more on the socio-economic aspects of the environment.

B N PAL
DELHI

What we changed: *Down To Earth* today takes into consideration both the political and socio-economic aspects of environment and development. We have featured numerous stories on the impact of river pollution, urban construction, mining and deforestation on the livelihoods of farmers, fishers and tribals.

9 Spotted a mistake

APRIL 1-15, 1995

In "How to kill four cheetahs barehanded!" (February 1-15, 1995), the news on cheetah deaths in

Delhi zoo had the picture of a leopard. It is a shame that large sections of the Indian press confuse the spotted animal with leopard. I hope you will be careful in future.

MADHUSUDAN KATTI
VIA EMAIL

10 Biased views

APRIL 16-30, 1995

Your story, "Lost in the jungle" (January 16-31, 1995), was disappointing. I consider *Down To Earth* a national magazine and on the issue of the Forest Policy Bill, the magazine should have brought forth views and experiences of non-profits, state forest departments and village institutions across the country. Instead, the story was restricted to covering a handful of Delhi residents.

G RAJU
AHMEDABAD

11 Ownership is not enough

JUNE 1-15, 1995

When you advocate villagers' ownership of natural resources, who are these villagers you are talking about? Most tribes today desire amenities like education and cooking gas. Will they get this simply by owning natural resources?

PRAKASH GOLE
PUNE

12 Scientist contributors

MAY 1-15, 1996

As one of the few science magazines in the country, you need to give greater coverage to issues related to science. But criticising scientific institutions is not enough. You should request scientists to contribute to your magazine.

V S ASHOK
HYDERABAD

13 Need more science

OCTOBER 1-15, 1996

I feel most of your cover stories are environment-related. There should be some coverage on science too. The design appears old-fashioned with too many graphics and illustrations in the stories rather than pictures.

S B SOMASUNDARAM
TIRUNELVELI

What we changed: Over the years, *Down To Earth* has evolved both in terms of content and design. The magazine was relaunched with a new look last year to make it more reader-friendly. We try to achieve a fine balance of science and environment and also cover other issues like health, natural resources, mining, energy and climate change.



14 Do you use recycled paper? DECEMBER 1-15, 1996

1996

The paper used for printing the magazine is synthetic and non-biodegradable. I request you to look into the matter and take action.

**V JANARTHANAM
COIMBATORE**

Editor's response:

We agree that we should be using eco-friendly paper for printing *Down To Earth*. But the "environmentally-benign" paper offered to us by different paper companies has been found to be nothing of the kind on further research. What is sold as wood-free paper could be manufactured from bamboo or other material like imported wood waste. However, we will continue our efforts to source such paper.

16 Sweeping statement JANUARY 1-15, 2001

I disagree with your editorial, "US tastes cream paste" (December 1-15, 2000). You noted that the *International Herald Tribune's* coverage of the conference on climate change was deficient and then generalised that "the US media blatantly avoided telling the citizens the reality". This newspaper is little read in the US and can't represent the US print media.

**E ABRAHAMSON
MINNEAPOLIS, US**

Editor's response:

Your letter has definitely caught me on the wrong foot. You are quite right that the *International Herald*

15 Denigrating women JUNE 16-30, 2000

Your cover photograph in the May 1-15, 2000, issue of *Down To Earth* was shocking. It is disheartening that we are subjected to such shabby treatment from a progressive magazine like yours. The cover photo not only objectifies women but also dehumanises her by showing just her legs.

**SHUBHA
VIA EMAIL**

Editor's response:

Down To Earth does not endorse the way automobile companies use women to sell their vehicles. In fact, our cover was done deliberately as a spoof to show how when these companies use glitz and glamour to sell their cars, they are actually selling people "cancer".



Tribune is hardly read in the US and that it cannot represent print media.

17 Missing facts JANUARY 1-15, 2001

Apropos "Now it is floods" (January 1-15, 2001), *Down To Earth* missed the heavy downpour and consequent floods of July 2000 in Ahmedabad, Gujarat. There was record rainfall, but none of the rainwater was harvested. It was a relevant issue for your magazine.

**KORAH MATHEN
VIA EMAIL**

18 Bogus claims FEBRUARY 1-15, 2007

The article, "Organic drive in Uttaranchal ignores farmers' concerns" (November 1-15, 2006), was disappointing and incredulous. The hotchpotch

of quotes attributed to people in the report does not appear authentic.

**DAVID HOGG
VIA EMAIL**

19 Why on earth GM crops? MARCH 1-15, 2007

The editorial, "Poor regulators do not a rich country make" (December 1-15, 2006), partially supports genetically modified (GM) crops. Isn't it irresponsible for an environment-friendly magazine to say that GM crops should be introduced?

**MAITREE DASGUPTA
VIA EMAIL**

20 Nuclear power, unclear issues DECEMBER 1-15, 2007

Your article, "ABC of 123" (October 1-15, 2007), leaves



much to be desired. It does not delve into the pros and cons of nuclear power. We are aware of the dangers, but many of us know little about the economic viability of nuclear power.

AJIT KOUJALGI
VIA EMAIL

21 Narrow thinking

DECEMBER 16-31, 2007

With reference to "Private affairs" (April 1-15, 2006), it is not fair to have such a narrow view about industry initiatives on setting up plantations. Why is *Down To Earth* so rigid about leasing out degraded lands to industries for plantations? Is it just because industries will make profits out of it?

PAYAL BHAIJANKA
VIA EMAIL

22 Criticism alone will not help

JANUARY 1-15, 2007

In "Another India is not ours" (October 16-31, 2006), the author has taken a biased position by criticising all special economic zones (SEZs). What is missing in the story is the key idea behind SEZs— generation of employment outside the agricultural sector.

NISHANT SINGH
VIA EMAIL

23 Speak about new technology

MAY 1-15, 1995

I think *Down To Earth* needs to provide more space to local innovations and technology which can make life easy for the common man.

FRANCIS FURTADO
GOA

What we changed: New sections in our

magazine, such as Technology, New Business, Initiative and Good News, feature products, technologies and ventures that people can use/ adopt to live a sustainable life.



NOTICE BOARD



Colloquim on Ecological Economic thoughts of Dr. J. C. Kumarappa and its relevance to India Today

19.10.2015
20.10.2015

State level
National level

Language
Tamil
English

Broad areas

1. Eco promotive Pro poor planning and Governance
2. Life enriching Production and consumption
 - a. Food b. Rural crafts c. Industries
3. Ethical Public Finance.

Venue

Dr. J. C. Kumarappa Grama Thozhil Solai
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Study papers are invited. Last date for sending study papers through email : 30.06.2015
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It is back

El Nino, which causes the worst droughts, may be pronounced this year, say reports



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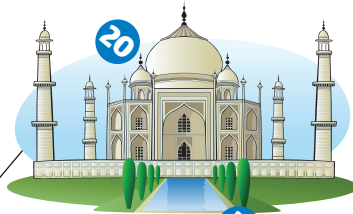
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By the metre

Poets' take on environmental degradation



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COVER STORY

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How well do we understand the ailments of the Taj Mahal?

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New study shows the Taj is still getting discoloured. Are we sure of the cause?

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Some of the Supreme Court's orders for the Taj Mahal have still not been complied with

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Chemicals were used in the past to clean the Taj without studying their effects



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23 inspiring stories of hope and courage

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The debate over homeopathy goes on

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Experts question the viability of carbon-negative technologies



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North Sea fish are declining due to rising temperatures

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Errant weather is testing the government's ambitious scheme



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Can there be knowledge dissemination without IPR?



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Famous sweet of Agra's been told to shift to clean fuel

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20-PAGE DTE SUPPLEMENT

WITH SUBSCRIPTION COPIES



59-78

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India's only sane magazine (managed by insane people)

ZZZZZ

I'm firm on my new year's resolution It's 300 DPI!

Don't use the word 'thesaurus'. Use its synonym instead

Do you know who coined the word coin?

Having too many shares! It's time to list us on BSE

Save trees, stop reading

I love web edition as it reminds me to clean the cobwebs in my home

My map is based on the stars. For best results use it on cloudy nights!

SARIT

DownToEarth

Endangered egosystem



May someone ask the tiger to smile?

The next to next to next issue aho!

How can they deny sick leave to the health reporter? It is unfair!

Not To Do List

Your story is full of mistakes!

Hurray! at last I got the word...I am confidently confused!

But this time I sent you blank pages!

Forest reporting has influenced my habits a little bit

I forgot why I have started laughing

Save the planet, promote recycled stories

I'm getting bored with white boards!

70 mm column width is OK but what is that dolby digital?

USE ME

WEATHER



REUTERS

The truant 'little one' is around

EL NINO, the weather phenomenon that has caused this century's worst droughts across the world, may be pronounced this year. The Bureau of Meteorology, Australia, confirmed that there is a 70 per cent chance of El Nino, meaning "the little one" in Spanish, happening this year. All international climate models monitored by the bureau indicate that ocean temperatures in the Tropical Eastern Pacific, one of the 12 marine realms that cover the shallow oceans of the world, continue to be warmer than average.

Trade winds are also weaker than normal and all weather models point to further ocean warming. The tropical Pacific Ocean sea surface temperatures are at present just shy of El Nino levels, indicating that there is a strong possibility of it happening.

In India, this weather phenomenon is historically related to severe drought. For the farmers who are yet to recover from a deficit monsoon last year and the damages from the unseasonal winter rains, this is worrying news. ■

Department of medical devices?

YES, YOU heard it right. A government-appointed taskforce on the medical devices sector has recommended such an administrative arrangement. Union minister of chemicals and fertilisers Ananth Kumar has already written to the Cabinet secretary to start the process. Kumar has also demanded that like the National List of Essential Medicines, there should be a list of medical devices that have a cap on their prices. Following

the task force's recommendation, the government is going to set up medical devices parks in the country. The first such park will be set up in Gujarat. The National Institute of Pharmaceutical Education and Research, Ahmedabad, will be the nodal institute for undertaking research in the area. The recommendations are meant to promote domestic production of high-end medical devices and pharmaceutical manufacturing equipment. ■



IN FOCUS

Net neutrality gains landslide verdict



Indian telecom major Bharti Airtel's decision to **charge its subscribers extra** for accessing popular apps like Skype and Viber has led to massive protests against such restrictions while using the Internet. This was Bharti's second attempt to do so.

This violates the principle of **Net neutrality** that new age citizens across the world guard zealously. This principle advocates that **all traffic on the Internet must be treated equally** by Internet service providers.

The recent buzz over this started when the **Telecom Regulatory Authority of India (TRAI)** circulated a 118-page consultation **paper on Internet regulations** that included a question about whether to allow Net neutrality.

About **a million people** at press time **petitioned** in support of Net neutrality and **political parties** buried their differences to **support** this. Flipkart, a major online shopping site, withdrew business consultation with Bharti.

An ending's burden

SUDAN, A 40-year-old male rhino living in Ol Pejeta Conservancy in Kenya, has a unique distinction—he is the last male northern white rhino in the world. And he may not like the attempt to save him: 24X7 armed guards. Not only this, to keep him away from harm, he has been de-horned and fitted with radio transmitters. Sudan shares Ol Pejeta with two female rhinos of

his subspecies. The trio is reportedly three of the last five remaining northern white rhinos in the world. Two other females live in captivity. There is hope that Sudan will one day be able to produce progeny and possibly save his kind from extinction. In 1960, there were more than 2,000 northern white rhinos roaming the earth, according to the World Wide Fund for Nature. ■

World account

IN THE past three years, nearly 700 million adults became part of financial inclusion services around the world, according to a World Bank report. This has brought down the number of unbanked individuals to 2 billion. Financial inclusion is measured by Global Findex, a World Bank agency, as having an account that allows adults to store money and make or receive electronic payments. It is critical to ending global poverty. "Access to financial services can serve as a bridge out of poverty. We have set a hugely ambitious goal—universal financial access by 2020—and now we have evidence that we are making major progress," said World Bank Group President Jim Yong Kim. However, the



JITENDRA / CSE

report did not take into account India's effort to financially include 130 million people last year. The country's effort started in August 2014 and went on till January 26, 2015. It will be considered in the next report. ■

VERBATIM



"For the families enduring separation and patients suffering pain, the wait is finally over"

— Nathan Deal, Governor of Georgia, USA, on legalising cannabis oil

H5N1 outbreak in Telangana

THE TELANGANA government has started culling chickens after an outbreak of bird flu was confirmed in Ranga Reddy district on the outskirts of Hyderabad. According to unconfirmed reports, as many as 300,000 birds have been culled so far. The government issued a culling order after

samples taken from Thoroor village of Hayatnagar mandal tested positive for the H5N1 avian influenza virus. Samples were tested by High Security Animal Disease Laboratory in Bhopal and the outbreak was confirmed on April 13. Several teams of Rapid Response Force have been pressed into the culling exercise in Thoroor. ■



PRASHANT RAVI

1 Curse called cancer

Anil Agarwal, founder editor of *Down To Earth*, was diagnosed with cancer in early 1994. In "My story today, your story tomorrow", (November 16-30, 1996) he wrote, "My cancer, like most cancers, is related to environmental pollution". His words still resonate. In 2013, WHO declared outdoor air pollution as group 1 carcinogen. Given Delhi's toxic air,



it is not surprising the state has the highest number of lung cancer cases in India.

2 Ebola remains elusive

Ebola virus, which first surfaced in Sudan and Zaire in 1976, made a comeback in Zaire in 1995, killing 250 people. In cover story, "What a bloody mess" (June 1-15, 1995), we asked: "Will the world learn a lesson from this disaster?" Apparently, it has not. The virus reappeared in 2013 in Guinea, this time spreading farther and claiming 10,000 lives worldwide. Since 1976, there have been two dozen Ebola outbreaks, yet treatment has not moved beyond experimental stage.



Tensions that continue

While launching this newsmagazine, our founder-editor Anil Agarwal had said that in the years ahead, India will have to seize every possible opportunity to grow and develop and at the same time it will have to make a bold effort to hold on to its soil and roots. On our 23rd anniversary, we bring you 23 issues where the country continues to falter

3 MGNREGA: Promises, failures

The Mahatma Gandhi National Rural Employment Guarantee Act (MGNREGA), 2005, was launched by the UPA government to provide 100 days of employment to rural families. The scheme saw an increased participation by women ("How women seized NREGA", November 1-15, 2010). Of late, it is losing its charm. People's participation has halved in the past few years ("The poorest shun MGNREGA", January 16-31, 2013). Experts blame it on delay in payment. NDA government has further slashed funds for the scheme.

4 Scent of a smuggled wood

In the 1990s, sandalwood in India got an unlikely fan—a brigand named Veerappan ("Catch me a colossus", October 1-15, 1997). His smuggling activities resulted in a large-scale destruction of sandalwood, what Anil Agarwal called the "effect of Veerappan phenemomen". Veerappan may be long dead, but smuggling has depleted the valuable tree to the point of near extinction.



5 Ganga dies a slow death

When Rajiv Gandhi launched the Ganga Action Plan in Varanasi in 1986, he stated, "We shall see the waters of the Ganga become clean once again" ("Purifying the Ganga", September 16-30, 1992). Thirty years later, his words remain as hollow as the promises of subsequent governments to clean the river. As it flows from the Himalayas into the Bay of Bengal, the Ganga "dies, not once but many times" ("Can we save Ganga?" July 16-31, 2014). Our cover story analysed why pollution is so persistent and suggested ways to clean it.



6 Mind matters
Bollywood actor Deepika Padukone was applauded for coming out in the open about suffering from depression. But few people battling mental illness—there are 19 million such people in India—come forward to share their experience. Our cover story, "Troubled, beautiful minds" (August 1-15, 2013) discussed where the government lacks. Last year, the government introduced India's first mental health policy aimed at providing quality treatment to mentally ill people.



8 Hypocrisy of Hinduism
From the immersion of chemical-laced idols to creating an ugly nexus of noise and noxious smoke on Diwali to poisoning the Ganga and Yamuna with untreated industrial and domestic effluents, the Hindu way of life is degrading the environment so intrinsic to the religion ("Pollution of Hinduism", February 1-15, 2000). We highlighted how authorities tend to ignore these issues fearing they might hurt religious sentiments. The situation has not changed much 15 years later ("Can faith heal?", February 1-15, 2013). The only improvement is that some lakes have incorporated special immersion sites in their lake conservation plan.

10 Disastrous droughts
"Are droughts here to stay?" asked our cover story dated June 1-15, 1992. That was the year when large parts of the country were grappling with drought, despite almost normal rainfall. Since then, drought has gripped some or the other part of the country almost every year. Through articles and editorials, *Down To Earth* has warned time and again that we must manage our water resources and introduce better coping mechanisms to avert such disasters ("Standing the test of drought", January 1-15, 2000; "Bleak future", October 16-31, 2001). But the government has failed to drought-proof our agriculture and economy.



9 Delhi inhales smoke
Delhi boasts the world's largest fleet of CNG buses. Achieving this was not easy. It took decades of right-to-clean air campaign, public interest litigation, Supreme Court orders and overcoming efforts of auto-makers to discredit CNG. ("The CNG sabotage", March 1-15, 2001). Sadly, diesel vehicles still outnumber CNG buses. Today, Delhi's toxic air is making global headlines once again.



7 Fight is on for forests
The Forest Rights Act was introduced in 2006 to recognise rights of forest dwellers. *Down To Earth* has covered enforcement of this landmark Act, meant to conserve the environment while ensuring development of tribals. Our reports show the Act has hardly met its objective ("How government is subverting Forest Rights Act", November 1-15, 2010). In 2010, it came to light that only 1.6 per cent of the 2.9 million claims under the Act recognised community rights guaranteed under the Act.



11 Mindless linking of rivers
The Centre has been touting river-interlinking projects as a solution to the recurring problem of drought. In 2012, the Supreme Court gave a go-ahead for such projects, despite growing evidence to show how these are detrimental to the environment. We have published several articles showing how such projects are drawing flak in other countries and are failing ("Riverlinking criticised", January 1-15, 2003; "Weak link", March 1-15, 2015).

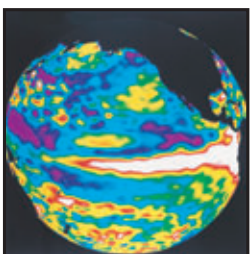


12 Naxals continue to hit
 In 2006, *Down To Earth* travelled to Dantewada, epicentre of the banned Salwa Judum, and unearthed the state's ulterior objectives: it was using the campaign to pit tribals against each other and thereby displace them and make land acquisition easier for industrialisation ("Red alert", October 31, 2006). Two years later, the then Planning Commission indicted Salwa Judum and said land alienation and poverty among scheduled tribes have contributed to the growth of Naxalism.



16 No action yet on climate change
 In our first issue, we reported about Earth Summit, where governments agreed to the United Framework Convention on Climate Change. Since then we have been following international negotiations towards reducing carbon emissions. But it appears world leaders are not serious about climate change: most meetings end up in watered down commitments; the North remains reluctant to transfer technology ("Cop-out", January 1-15, 2015).

13 Frequent El Nino
 In 1997-98, when El Nino developed in the Pacific, it was called the worst of the last century ("Winds of change", December 1-15, 1997). The weather event caused severe drought, forest fires and crop loss in several countries ("Global havoc", December 1-15, 1997). Scientists were clueless about the extent of damage it could cause. Since then, El Nino has devastated



the world five times, each time causing drought in India. Weather scientists continue to be clueless about the weather phenomenon and fail to accurately forecast it ("Pray before you sow", July 1-15, 2014).

14 Antibiotic trap tightens
 In 2014, when WHO warned that resistance to antibiotics is spreading as a major public health threat, the Centre introduced a policy to restrict the sale of antibiotics to curb the growing resistance. The move seemed impractical in the Indian setting where there are no checks on over-the-counter sale of antibiotics.

We spoke to experts in "Fatal resistance" (October 16-31, 2011) and offered ways to curtail the irrational use of drugs. While the government is yet to act on any of the suggestions, in 2014, our correspondents, along with Centre for Science and Environment researchers, found that poultry meat could be churning out robust microbes that could render all antibiotics ineffective ("Hatching superbugs", August 1-15, 2014).

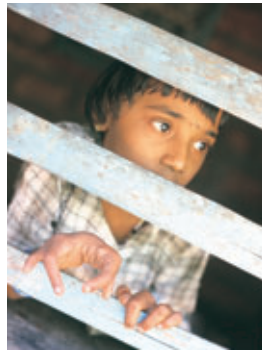


15 Death under the knife
 Sterilisation camps flout all guidelines to bring down the fertility rate. Counselling on birth control methods often turns into a means to impose family planning on the poor ("When birth control means business", July 17, 2012). Following deaths of women who underwent sterilisation in Chhattisgarh last year, our investigation ("Operation cover-up", December 16-31, 2014) exposed flaws in India's family planning approach.



17 Mad growth
 Heavy rains and landslides devastated Uttarakhand in 2013. Next year, floods ravaged Jammu and Kashmir. The Himalayas are the world's youngest mountain range, prone to landslides and flash floods. But unchecked construction, mining, choked catchment areas and hydel projects have made it hazardous. We have been highlighting the issues since 1998 ("Is Tehri dam safe?", January 1-15, 1998). Now Uttarakhand is pushing for more dams; Jammu and Kashmir is yet to recover catchment areas.

18 Endosulfan conspiracy continues
In 2001 *Down To Earth* travelled to Kerala's Kasargod district and found that the high cases of deformities and diseases in Padre village was due to spraying of endosulfan pesticide on cashew plantations ("Children of endosulfan", February 16-28, 2001). Following a study, the Centre and the state banned spraying of endosulfan, only to lift it within months ("Endosulfan conspiracy", July 1-15, 2002). Kerala again banned endosulfan in 2005, but the pesticide is widely available in neighbouring states.



22 Slow wind
In 1992, our article "Wind power, up, up and down" had warned that poorly implemented governmental policies are preventing the full exploitation of wind power which could supplement as much as 25 per cent of the country's electric energy requirements. Two decades later, we published another article "Wind loses power", which shows Tamil Nadu has 40 per cent of the wind energy capacity installed in India, yet the state is reeling from power crisis.



23 CAMPA fails
In 2002, the Supreme Court ordered state governments to collect money for projects that felled forests and deposit with Compensatory Afforestation Management and Planning Authority or CAMPA. But the Union environment ministry has no record of how much money is due from states. Every year 10 per cent of the amount accumulated under CAMPA is released to state CAMPAs, but states complain that the money they receive is not enough.



19 Duped for organs
In 2008, a multi-crore rupee organ scam hit the headlines. The media went into overdrive, splashing sordid stories of the labourers who were duped into donating kidneys. But we asked a different question: Is the country's Organ Transplant Act adequate? Following the incident, the government amended the Act to widen the donor pool and prescribe stringent punishment for commercial dealing in human organs. Unfortunately, many say, the law is not stringent enough.

21 Complacent about Arctic
In our cover story in May 16-31, 2012, we discussed how nations surrounding the Arctic, India and China, are in a frenzy not to let go of even an inch of their territory and the huge natural resources trapped beneath it. We asked, "Is Arctic rush worth it?" Scientists warn that locked in its permafrost is twice as much carbon as in the atmosphere. Freeing up of this carbon and access to more hydrocarbons will accentuate global warming. A recent study published in *Nature* in April 2015 underscores our fear. It says 1,330-1,580 billion tonnes of carbon is stored in permafrost in the northern



hemisphere, which is likely to be released over many decades. These emissions would translate into an additional climate warming of 0.13-0.27°C by 2100, and up to 0.42°C by 2300.

20 What a waste
In 2007, we analysed the benefits and cost of waste disposal system. Businesses want to burn garbage to produce electricity. Environmentalists say this is not viable, given Indian conditions and toxic emissions. India should have amended its Municipal Solid Waste Rules of 2000 by now to address these issues. But it has not. The result is increasing conflicts between people and urban bodies ("Stench in my backyard", September 1-15, 2012).





THE INVISIBLE MOUNTAIN
By J Swaminathan

Arms outstretched on the edge of
the cliffs
Stand a few trees
Ready to fly away with the clouds.

They say these deodars once
Kissed the Koku nala
And embraced the skies so tight
That the stars were startled
By the village glow-worms every night.

Now when the corn touches gold
A scoundrel bear
Swoops down the slopes
Blazing destruction
All our pistols and double-barrelled guns
Fail to stop him.
Maharaj, where is that old rogue this year?

The mountain before you
Hides another from view.
Ascend the slopes to Rana Ki Kot
And look across
But the mountain will not appear
It is drowned in mist
To float up staid
Unmoved.

Look
The slate on the watermill still shimmers
The corn spreads in yellow sheets
The cowherds laze around, watching
Across the valleys the cattle are grazing
You say the mountain
Shrouded in mist
Would reappear.

But see how clear is the sky
No mist, no fog
No wisp of a cloud stuck on a cliff-top
That mountain is not visible, Maharaj.

You cannot see on the mountain
The gujjar camp
With long-waisted women dressed in black
And the wild dogs with eyes of burning coal.

That mountain is not visible, Maharaj
Its silence hides behind
The mountain before you
A wounded deer waiting to spring.

J Swaminathan was a painter and poet. This poem, published in Down To Earth (December 16-31, 1992), was translated from the original Hindi by Amit Mitra



TRUTH IS WHAT MY FATHER TAUGHT ME
By Jayanta Mahapatra

Truth is what once my father taught me
but that was years and ages back.
Today it gives me a cynical look from the ozone hole.
Its voice has lost its music, choking on chlorofluorocarbons,
it is just a voice that has airlessness to cross.

What do I care about leaders such as Bush or Major?
Or the nuclear power plant in Iowa I visited once,
or the deep, fiery throat of NASA?
Or European autobahns, or the ad for cat food which says:
Shouldn't your cat eat like a hero too?
The stomach of hopes begins to empty itself
when we stop to rest and think.
Nothing but green bile comes up even at a domestic summit.

Nothing but the inexhaustible delirium of a solitude that runs away as we continue to stalk it.

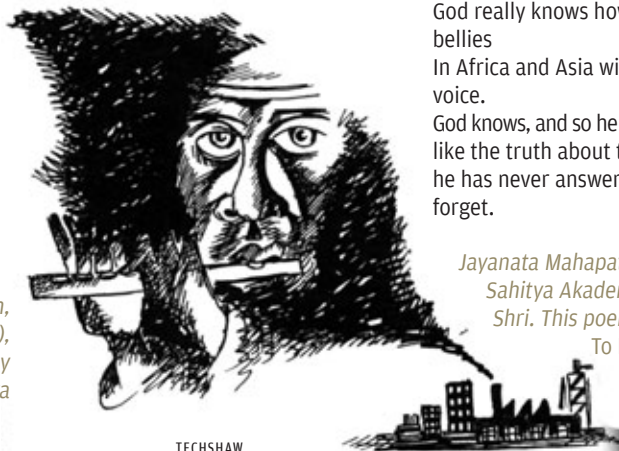
If a billion people live in absolute poverty, do I have to worry? So what if rainforests go?
The plush automobile still stands haughtily at the door.
God tells my people in that remote village of Koraput that they'd have to pay for the sins of past lives.

God really knows how to fill up hungry bellies
In Africa and Asia with the silence of his voice.
God knows, and so he has gone on and on, like the truth about those questions he has never answered and I so want to forget.

Jayanta Mahapatra is the recipient of Sahitya Akademi award and Padma Shri. This poem, exclusive to Down To Earth, was published in August 1-15, 1992

of mountains & ozone holes

When poets wrote for
Down To Earth



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TWO DECADES OF PROTECTING THE TAJ MAHAL

Daunting journey

A chronicle by
SUNITA NARAIN with **ARUNA P SHARMA** and
JYOTSNA SINGH in Agra

Photographs : **VIKAS CHOUDHARY**

Infographics: **RAJ KUMAR SINGH**

APPRAISAL

The Taj puzzle

"If India has to reconcile the conflict between industrialisation and environmental sustainability, its technological and management choices will have to be built on good science. This is necessary to ensure that the pain of industrial closure and joblessness is reduced to the absolute minimum"

This is what Anil Agarwal, *Down To Earth's* founder editor, had to say when this fortnightly had done an investigative story questioning the scientific evidence that indicted small-scale industries for pollution and damage to the white marble of the Taj Mahal.

On the 23rd anniversary of *Down To Earth* it is important for all of us to return to this monument of love, the Taj.

Not only because it is an iconic and glorious monument that needs to be cherished by us all.

Not only because the fight to save the Taj from pollution is the country's longest and perhaps most difficult battle. It began in 1983, when 10,400 sq km of area was declared the Taj Trapezium Zone and polluting units were prohibited (see 'The right zone', p24). Since then the Supreme Court has directed action to clean the Taj and huge costs have been paid, particularly by local industries and residents, to close down polluting units or to relocate them.

Not only because now it is feared that this battle may not be over. Recent studies have once again suggested that the scourge of pollution is still adversely affecting the white marble of the Taj. This time, it is not sulphur dioxide, which was suspected in the 1980s of turning the gleaming façade yellow. This time the villain is black and organic carbon particles that are emitted from vehicles and other polluting units. But again, it is important to ask whether we know the cause of the problem? Already, the administration is gearing up for another purge—this time it wants to remove all the makers of *pettha*, a unique and local sweet made of, believe it or not, the common vegetable, ash gourd. But will this be enough? Should it even be done? For Taj's sake.

But also because it is important to understand how we will succeed in such highly contested and protracted efforts to clean our cities or rivers. The Taj Mahal is a piece of amazing architecture and beauty, a tribute to our past. But how can it become modern India's tribute to the balance between environment and development?

Discolouration: why is Taj turning yellow?

What do we know of the state of Taj discolouration? Is it extensive; is it leading to irreversible damage or is it about surface stains that can be cleaned? In its 1996 landmark judgement, the Supreme Court drew upon the petitioner lawyer M C Mehta's assessment, which it quoted as saying that the white marble had yellowed and blackened in places. "Yellow pallor pervades the entire monument. In places the yellow hue is magnified by ugly brown and black spots and according to the petitioner the Taj is on its way to degradation due to atmospheric pollution."

This was when the court also had before it a scientific study, which contradicted this claim. The government-appointed committee under the chairpersonship of S Varadarajan, the then chairperson of the Indian Petrochemicals Ltd, had commissioned Italian company Tecneco to study the impact of pollution on the Taj. A petrographic, chemical and physical analysis of marble samples—from the Taj and also from the original quarries at Makarana in Jaipur—concluded that the cause of deterioration and black spots was not pollution, but microscopic algae.



The Lucknow-based National Research Laboratory for Conservation of Cultural Property (NRLC) conducted further studies to look at the different types of deterioration, from discolouration of the surface, either uniformly or in spots, and breaking of marble edges to cracks and erosion of the surface. Their overall analysis was that these issues had little to do with pollution and more to do with dirt deposits and maintenance. For instance, the reason for “yellowing”, they concluded, was the deposit of dirt or the application of resin that was used to preserve the monument.

OP Agrawal, the then director of NRLC, wrote prophetically, “Control of atmospheric pollution from Mathura Oil Refinery or from locomotives or from local factories, foundries, although extremely important and desirable, is not going to solve the problem of alteration and deterioration of Taj Mahal.” This needs more studies to understand the causes so that we can address the problem.

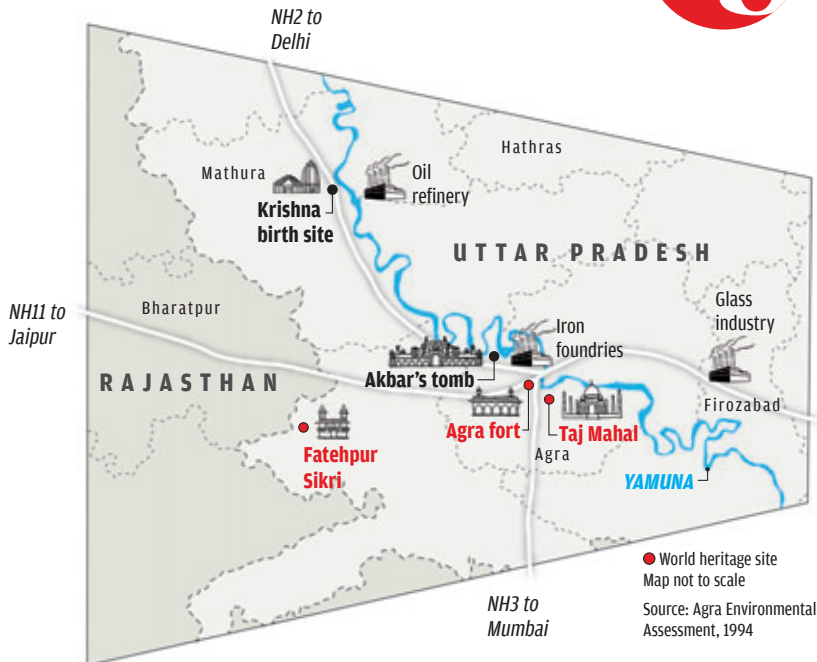
But his message to use science to inform decision-making was ignored then as well as now. Since then, there has been even less research on the causes of deterioration of the monument. The studies only point to the extensive problem of pollution in the vicinity of the Taj and in the airshed of the Trapezium. Clearly, this is not enough, and for two reasons. One, we will not be able to fix the problem unless we know the underlying cause. A 2014 study, which found the Taj still discoloured, is now indicting high pollution because of black and organic carbon particles. While this may be enough to say that more must be done to control air pollution for the health of Agra residents, it is not enough to determine the actions needed to conserve the Taj. It is time we had more clarity, otherwise, another few decades later discolouration will again be the headline and by then it may be too late to save the Taj.

Second, we will not be able to convince people of the actions that need to be taken unless we have information and evidence at hand. The fact is that poor people in Agra have paid a big price to keep the environment of the Taj clean (or cleaner). Industries have been closed down, relocated and many lives disrupted, made poorer. This was possible because the directions came from the Supreme Court, which was acting in public interest. But it was also possible because people who were impacted by these decisions were poor and powerless.

As India becomes richer, more literate or politically informed, it will be much more difficult to push through such necessary actions, without hard, credible data on the nature of the problem and the steps required to be taken.

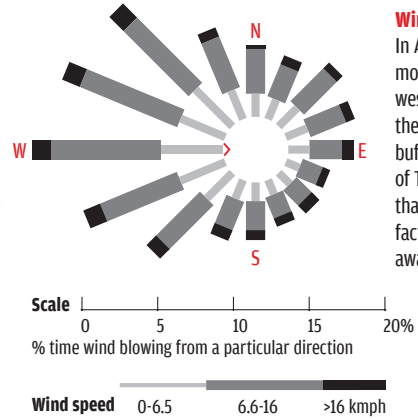
‘We cannot wait for the Taj to suffer the damage’

There is no doubt that pollution—acidic formations from sulphur and nitrogen oxide particles or soot from black and organic carbon particles—will take a toll on the monument. How much and how serious can be debated. But damage they will do. Speaking to *Down To Earth* in 1996—when the issue of relocation of small industries was raging—P Khanna, the then director of the National Environmental Engineering Research Institute (NEERI), had said, perhaps rightly, that “we cannot



The right zone

The 10,400 sq km Taj Trapezium Zone, which was demarcated in 1983 to protect the Taj Mahal, has three Mughal-era World Heritage Sites



wait till the Taj actually suffers damage". The court took pre-emptive action in the interest of conserving the wonder of the world.

There is also no doubt that the Supreme Court directions to clean the Taj and to find alternatives to dirty energy use in its vicinity have been far-reaching and bold.

First, the Court ordered that the polluting units in the vicinity of the Taj be identified. Mainly foundries; glass and bangle manufacturing units; and chemical and engineering industries were found to be using coal and other polluting fuels. The court also ordered that the Gas Authority of India Ltd would supply cleaner fuel—natural gas—to these units. This was done and a 170 km pipeline to the Taj Trapezium was laid. According to the Uttar Pradesh government's affidavit to the court, 187 units were closed; 42 moved to natural gas and 53 to electricity. Clearly, enormous work was done to bring this transition.

This was not all. The court, in its 1996 judgement and subsequently, asked for many other things to be done such as creating a green belt; building a bypass for heavy traffic; ban on brick kilns within 20 km from the Taj; supply of uninterrupted power so that the use of generators is negated; and ban on diesel-driven, light-duty vehicles and three-wheelers within 500 metres of the monument.

These steps have had an impact. The court-ordered air quality-monitoring stations, located both near the Taj and in the industrial outskirts of the city, prove the difference. There is a drastic reduction in all pollutants between 2005, when natural gas became available, and 2012. More importantly, pollution around the Taj—monitored by the Archaeological Survey of India and the Central Pollution Control Board—has reduced dramatically.

The question now is: why should the Taj still be under threat? Is it because there are new sources of pollution that were not accounted for in the earlier decisions; or is it because governments have not implemented the directions of the court yet? Or is it because the airshed is polluted and it is no longer enough to keep the quality of air close to the monument clean. For instance, in Agra and Mathura vehicular traffic has imploded. The city has not invested in public transport and even though compressed natural gas (CNG) is available it has not made optimum use of this clean fuel.

Then, power supply remains erratic. NEERI's 2013 report finds that there is 178 per cent growth in generators in commercial shops in the city, as compared to 2001. However, the generators in the glass industries in Firozabad are based on natural gas and not diesel. But garbage disposal is unsatisfactory. Open burning continues, adding to pollution. What is clearly needed is to assess the sources and actions taken till date on the different court orders and then work out the second-generation, air pollution-control measures for the Taj Trapezium.

The one thing that should not be done is to turn the people of Agra against the conservation of their city's monument once again. This clearly is the most important opportunity we must seize.



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POLLUTION

Black spot

Threat of discolouration returns to haunt the Taj

Taj Mahal, the domed marble mausoleum on the bank of the Yamuna river in Agra, is iconic for more than one reason. It represents the best of Indo-Islamic architecture and serves as a symbol of beauty and love. What is less known is the fact that it also symbolises India's battle for clean air.

The issue of pollution around the Taj has its roots in the 1973 decision to set up a petroleum refinery at Mathura, near Agra. In 1981, based on reports of committees that looked into the pollution threat, government closed two thermal power plants in Agra and shifted to diesel in its railway shunting yards there. In 1983, the Ministry of Environment and Forests declared some 10,400 sq km of the Agra-Mathura region as a protected area called Taj Trapezium Zone, where polluting industries were banned. A year later, lawyer M C Mehta filed a case in the Supreme Court, asking for the Mathura Oil Refinery to be shifted.

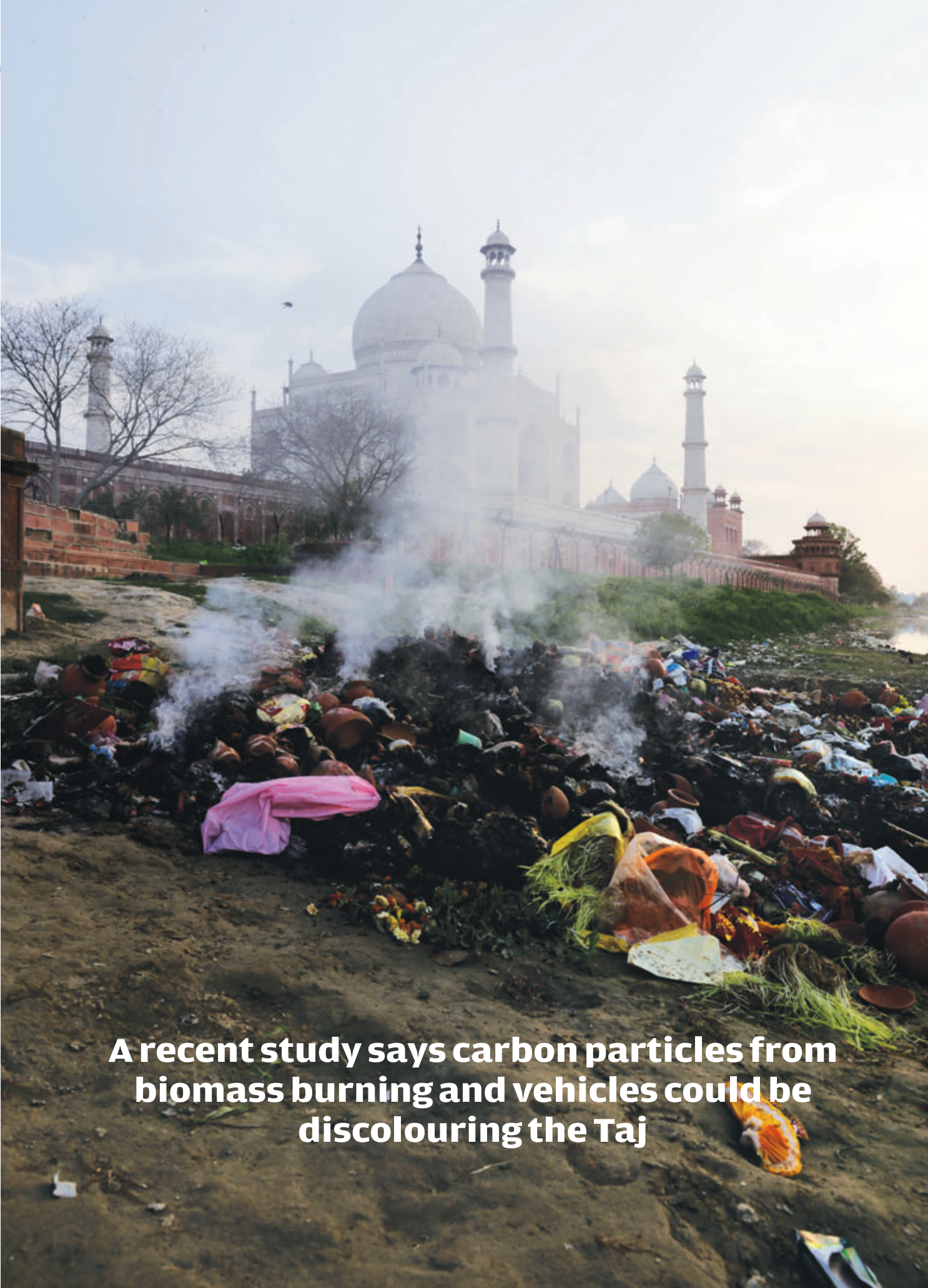
The Bench of green judge Justice Kuldeep Singh began hearing the case some years later. In 1993, a report by the Nagpur-based National Environmental Engineering Research Institute (NEERI) on the causes of pollution held small-scale industries of Agra and Firozabad—foundries and the engineering and glass units—responsible for pollution that was damaging the Taj. It recommended that these industries should be relocated outside the Taj Trapezium. It also asked for a green belt around the Taj to save it from pollution. The court ordered this to be done.

At that time a question was raised whether the court had adequate information to make the decision about the source of pollution threatening the Taj. In 1994, another report was commissioned. This time to eminent scientist S Varadarajan. His findings contradicted NEERI. Varadarajan held that there was no pollution-related damage to the monument. He said the problem of poor air quality did exist and was because of vehicles and diesel generator sets. However, he did not oppose the relocation of industries, but said that they could be shifted to nearby sites and not out of the Trapezium. So this was ordained.

Since then, the Supreme Court has issued a number of directions to protect the Taj. It has asked for everything to be done, including the supply of compressed natural gas (CNG) in the Taj Trapezium to reduce particulate matter emissions and the provision of adequate water in the Yamuna. After some action the matter of pollution around the Taj Mahal got erased from public memory. It was something that was done. Completed. Till now.

In December 2014, a study by the Indian Institute of Technology (IIT)-Kanpur, University of Wisconsin and Georgia Institute of Technology, both in the US, found that the Taj Mahal was still under the pollution cloud. The study collected samples of particulate matter around the Taj over a year to find relatively high concentration of light-absorbing particles called black carbon as well as organic carbon and dust. When the researchers studied the surface of marble pieces placed in the Taj complex they found the same particles deposited there. They concluded that black and organic carbon particles—from vehicles and biomass burning—and dust are responsible for the discolouration of the Taj Mahal. "We calculated the amount of light reflected by these particles and compared the modelled reflectance with human colour perception to conclude they play a significant role in causing surface discolouration of the marble," says Sachchida Nand Tripathi, one of the researchers and professor at IIT-Kanpur.

Media reports on the finding prompted the standing committee of Parliament on science,



A recent study says carbon particles from biomass burning and vehicles could be discolouring the Taj

Dangers to

TAJ MAHAL

NATURAL CAUSES

Mineral impurities present in the marble get oxidised and create brown stains. Rains also have a weathering effect on the marble and have been noticed to cause chipping and cracking. The iron dowels used to fix the marble slabs on the building get rusted and the rust flows down with rain, getting deposited on the marble.

AIR POLLUTION

A recent Indo-US study found that dust and carbon-containing particles are settling on the Taj Mahal and causing discolouration. Earlier, the Mathura Refinery and small industries were seen as the cause for the "yellowing" of the monument, prompting the Supreme Court to order use of cleaner gas fuel by these units.

TREE FELLING

A large number of trees have been felled in Agra in recent years to build roads and other infrastructure. Agra lies in a semi-arid zone, near the desert state of Rajasthan, and experiences very hot summers when temperatures touch 49 C. Hot dusty winds have an abrasive effect on the marble. Increasing green cover and water bodies is one way of curbing dust pollution.

TOURISTS

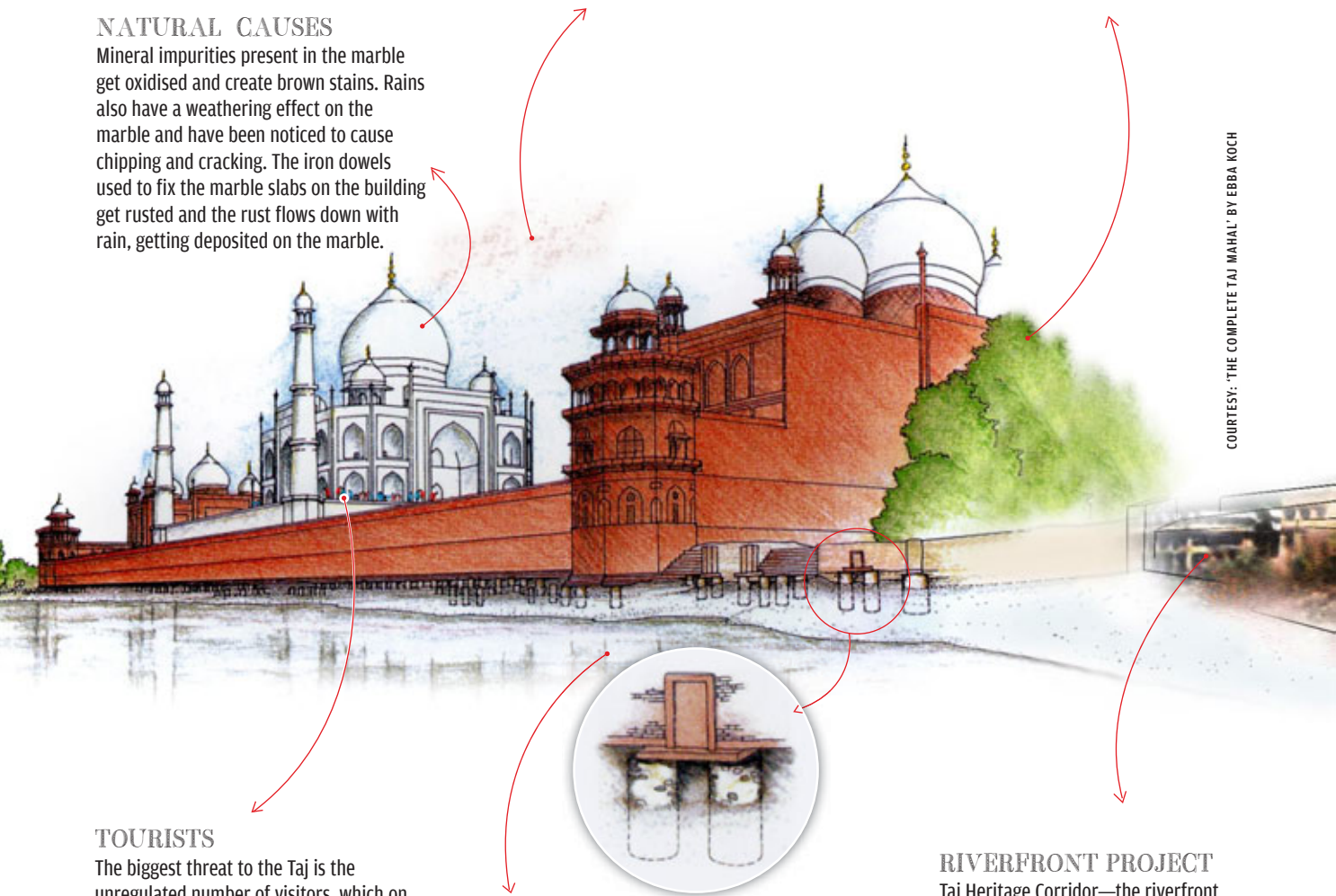
The biggest threat to the Taj is the unregulated number of visitors, which on some days is over 50,000. Constant treading wears down the marble floors. Presence of visitors increases humidity inside the building and the grease from their palms causes deposition of grime on the walls. The greater threat is to the red sandstone used in the Mehman Khana and the mosque on either side of the Taj. Unlike marble which is hard, red sandstone is porous. The weathering of the Mehman Khana is very obvious.

RECEDING, POLLUTED YAMUNA

Media reports in 2011 suggested the receding Yamuna is weakening the sal wood (*Shorea robusta*) in the foundation of the Taj Mahal which needs constant moisture to prevent it from cracking. Taj's foundation, built of brick, watertight mortar and wood, is supported by circular wells dug in the river bank to give it stability. The low flow in the river and the high pollution are also major causes of concern. ASI, however, says it has no evidence that wood has been used in the foundation.

RIVERFRONT PROJECT

Taj Heritage Corridor—the riverfront project of former Uttar Pradesh chief minister Mayawati—comprising food plazas and malls, planned between the Agra Fort and the Taj was shelved on Supreme Court's orders as it could have been a threat to the monument. Sand accumulated in the reclaimed river bed can erode the marble surface during sand storms, says ASI. The site is yet to be turned into a green belt as directed by the court.



COURTESY: 'THE COMPLETE TAJ MAHAL' BY EBBA KOCH

Cause of concern

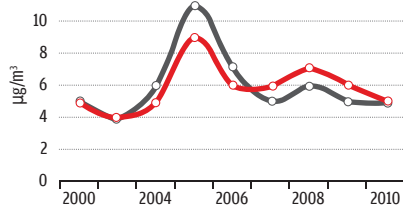
Air quality around the Taj is much better now than it was 15 years ago. But respirable suspended particulate matter (RSPM) is still two times the permissible limit



— Taj Mahal — Nunhai

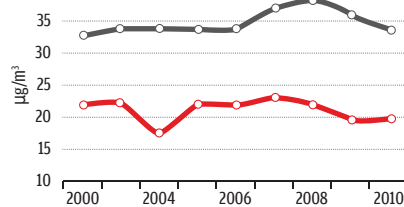
Annual variation in SO₂ levels (2002-10)

Standard level 20 µg/m³



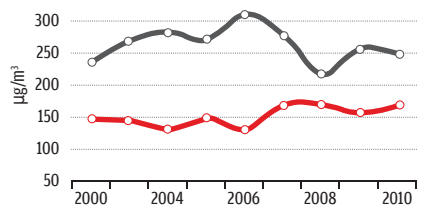
Annual variation in NO₂ levels (2002-10)

Standard level 30 µg/m³



Annual variation in RSPM* levels (2002-10)

Standard level 60 µg/m³



Source: NEERI

technology and environment to visit the Taj Mahal on April 10. The committee pointed to black spots on the minarets flanking the mausoleum, and asked the Archaeological Survey of India (ASI) to seek expert advice, if required, to clean the marble facing. “We are concerned by news reports that the directions of the Supreme Court for preserving the Taj Mahal have not been complied with and the discolouration of the monument is a reality,” says Ashwani Kumar, Rajya Sabha member and chairperson of the committee. Members of Parliament who visited the Taj are expected to submit a report to Parliament during the current budget session.

Pollution puzzle

But all this leaves crucial questions unanswered. Why is the Taj getting discoloured? What is the source of pollution? In 1993, NEERI blamed it on acid rain, which happens when sulphur dioxide (SO₂) and nitrogen dioxide (NO₂) particles in the air combine with fog droplets and water condensation. But the measurement of pH value to gauge the acidity or alkalinity of rainwater and the waste water after washing the Taj contradicted this theory.

As a result, the court orders culminated in the landmark judgement of 1996 that directed the closure of 292 small industries, including 168 foundries, if they did not relocate or switch from coal and coke to CNG, a cleaner fuel. The Mathura Oil Refinery, which started operations in 1982 and was found emitting high levels of SO₂, was asked to switch to gas fuel. The order led to the closure of most of the small industries and almost all foundries in Agra in 2001. The Mathura Refinery switched to CNG in phases by 2005.

At the time of the judgement, the court’s prime concern was SO₂ emissions, which, it feared, could lead to acid rain and damage the marble surface of the mausoleum. The judgement also noted that “soot in itself is not harmful but that with tar it acts as a soiling agent” and that absorption of acidic gases is also enhanced by the presence of soot. The judgement quoted views of two foreign experts who said suspended particulate matter and dust were causing the marble to appear yellow.

Pursuant to court directions, the Union government and the Agra administration took a number of steps to clean the air in the Taj Trapezium Zone. Now CNG is the fuel of choice in the zone, no vehicles are allowed within half-a-kilometre of the Taj Mahal, and a green belt is under development around the monument to filter out pollutants.

The IIT-Wisconsin-Georgia study suggests that it is not acid rain, but black and organic carbon that is the cause of the problem. The source is incomplete combustion. Black carbon comes from diesel vehicles and brick kilns, and organic carbon from biomass burning. This would mean that the orders of the Supreme Court that would have reduced pollution from these sources have not



Supreme Court had ordered adequate drains and sewerage in Agra but only 17 per cent of the city is covered by sewerage network

been implemented or that there is something new and different that needs to be addressed. Already, based on this study and a little more information, the city administration is rushing to close down *petha* (sweet made from ash gourd) units as these use coal and wood (see 'Man v monument', p42). Is this going to be the solution? Is this even the problem?

Key indicators down

In 2000, the Supreme Court had directed the Central Pollution Control Board (CPCB) to set up four monitoring stations to check ambient air pollution. By 2013, the city added four more stations, including one operated by ASI in the Taj Mahal complex and three by the Uttar Pradesh Pollution Control Board.

NEERI has analysed pollution data for the past nine years in its December 2013 report on a comprehensive environmental management plan for the Taj Trapezium.

It has found dramatic reduction in key pollutants SO₂ and NO₂ at the Taj Mahal between 2002 and 2012. The biggest difference is seen after 2005, when CNG was introduced in the city. The level of PM10 at the Taj was significantly lower than at Nunhai, an industrial area outside the city, but was still two times the permissible standard of 60 µg/m³ (see 'Cause of concern', p29).

In other words, pollution has definitely reduced in the city and more importantly, the levels are much lower in the vicinity of the monument. Now the question is whether these levels of particulate emissions are sufficiently high to cause discolouration of the marble. It is known that black carbon and organic carbon are a fraction of the particulate matter.

Clearly, the monument of love needs some more attention and care from us. We need to know the real cause of the problem so that the real answers can be found.

Unfinished agenda

Supreme Court orders to curb industrial emissions in the Taj Trapezium Zone have been implemented but progress in several other areas is a concern

The Taj Trapezium case, seeking the Supreme Court's intervention to protect the Taj Mahal from the adverse effects of harmful air pollutants, is one of the longest-running environment court cases in India. Filed a year after the monument was declared a World Heritage Site in 1983, the petition blamed Agra's foundries, hazardous chemical industries, and the oil refinery at Mathura as the major sources of pollutants damaging and discolouring the Taj. It said sulphur dioxide (SO₂) emitted by the refinery and the industries, when combined with oxygen and moisture, formed sulphuric acid which had a corroding effect on the white marble of the building.

The petition led to the apex court passing a series of orders to protect the air, water and land around the Taj Mahal as well as in the entire Taj Trapezium Zone (TTZ).

Turning point

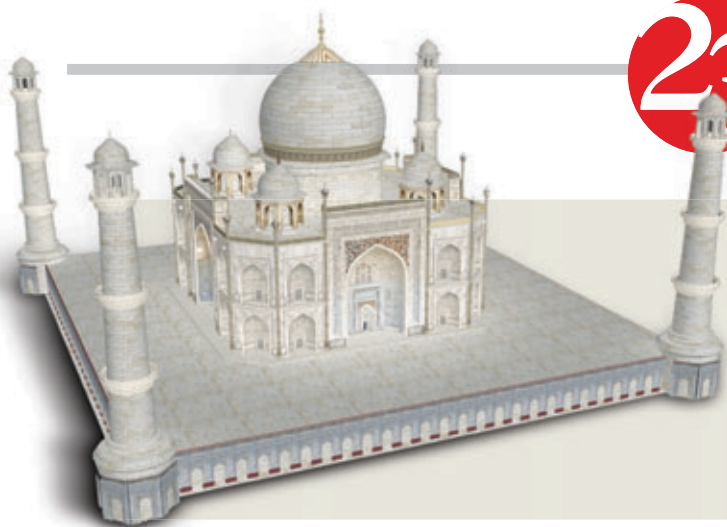
The turning point in the case came on December 30, 1996, when the Supreme Court (SC) asked 292 small industries in Agra to either shift to natural gas or shift out of TTZ by February 1997, failing which they would be closed. While passing the order, the court mainly relied on the report prepared by the National Environmental Engineering Research Institute (NEERI) in 1993, which held small-scale industries of Agra (mostly foundries) and glass industries of the neighbouring town of Firozabad responsible for the pollution. Factory owners and workers protested, saying they were unfairly targeted and that the Mathura Refinery was to be blamed (see 'The trouble with the Trapezium', *Down To Earth*, April 15, 1996). In its December 1996 verdict, SC said it would monitor TTZ-related projects and proposals. These include:

- Setting up of hydrocracker unit in the Mathura Refinery
- Construction of a 24 km Agra bypass road to divert traffic passing through the city
- Provision of uninterrupted power supply in TTZ to check use of polluting diesel generators
- Construction of Gokul barrage on the Yamuna in Mathura to improve supply of drinking water and to bring life to the river
- Development of a green belt around Agra as recommended by NEERI
- Creation of a separate cell under the Union environment ministry to safeguard and preserve the Taj, the city of Agra and national heritage monuments in TTZ
- Shifting of emporia and shops functioning within Taj premises
- Declaration of Agra as heritage city.

The court closely monitored compliance of its orders. From 1993 to 1996, when Justice Kuldip Singh was heading the Bench, hearings were held almost on a weekly basis. The court also deputed an *amicus curiae* and appointed court committees to report on ground reality.

A perusal of court orders and official documents in the public domain in the Taj case shows that many court directions, especially those relating to controlling air pollution, have been complied with. But other directions are yet to be fully implemented.

About 10 years after the 1996 judgement, SC reviewed the status of some of the projects it was monitoring and sought reports on Agra bypass road, green belt and provision of uninterrupted electricity supply in its order dated August 7, 2006. The status of the compliance with various



Order and disorder

Supreme Court has been monitoring enforcement of its orders, but a lot more needs to be done

March 31, 1994 | Uttar Pradesh asked to submit list of units in TTZ for relocation.



February 25, 1994 | SC examines NEERI recommendations on use of gas fuel in Mathura refinery and other units in TTZ (Mathura refinery's switchover to gas fuel completed in 2005)

October 1993 | NEERI submits report on SO₂ emission control measures for Mathura refinery, recommends use of natural gas as fuel

August 27, 1993 | Closure order passed against 212 industries that failed to install air pollution control devices



July, 1993 | NEERI says units using coal and coke as fuel are the major polluters; suggests changes in TTZ boundaries



April 29, 1994 | Considering 57,800 workers would be affected, SC orders setting up another panel to probe pollution sources; panel constituted under S Varadarajan

August 8, 1994 | Court informed that gas pipeline for Mathura refinery would be completed by December 1996. (At present, 90-odd units run on gas and electricity in TTZ)



April 1995 | Varadarajan panel submits report, recommends relocation of industries out of TTZ

August 3, 1995 | SC orders the Centre and Uttar Pradesh government to prepare relocation scheme

February 20, 1996 | SC takes note that none of NEERI's recommendations had been enforced by the Centre

November 29, 2000 | Uttar Pradesh sanctions ₹4.56 crore for Agra Heritage Fund



November 7, 2000 | SC directs setting up four air quality monitoring stations in Agra. These become functional in 2002 at the Taj Mahal, Etmad-daula, Rambagh and Nunhai

November 3, 2000 | SC directs CPCB to lay down special air and noise pollution standards for TTZ. (Ecologically sensitive area standards are applicable in TTZ since 2009)

May 17, 1999 | TTZ Pollution (Prevention and Control) Authority constituted to monitor schemes for protecting the Taj

February 23, 1999 | Cabinet Committee on Economic Affairs approves schemes worth ₹222.21 crore for projects to improve air, water and land in Agra



December 14, 2000 | SC orders the Centre to release funds to ensure survival of 1,215,500 saplings planted by the Uttar Pradesh forest department for a green belt around the Taj at a cost of ₹4.03 crore

October 3, 2001 | Foundry owners asked to file undertaking to switch to gas-based technology by October 10, 2001, failing which they would close (187 close shop)

April 11, 2002 | SC takes note of CPCB report, saying air quality has still not improved. UPPCB asked to ascertain reasons



July 16, 2003 | SC orders CBI inquiry into ₹175 crore Taj Heritage Corridor scam after diversion of the Yamuna river, to reclaim over 30 ha between Agra Fort and Taj Mahal for food plazas and shops, is noticed

1973 | Proposal to set up a refinery at Mathura, 40 km from the Taj Mahal sparks debate over the danger it would pose to the Taj

1974 | Expert panel headed by S Varadarajan submits report saying emissions from refinery would be limited to one tonne/hour

1978 | Joint Parliamentary Committee headed by Karan Singh opposes Mathura refinery

1981 | Government closes 2 thermal power stations in Agra and replaces coal with diesel as the fuel in railway shunting yard

1981-82 | Central Pollution Control Board (CPCB) demarcates Taj Trapezium Zone (TTZ)



January, 1993 | SC orders National Environmental Engineering Research Institute (NEERI) and UPPCB to help industries set up air pollution control devices

January, 1993 | SC orders Uttar Pradesh Pollution Control Board (UPPCB) to identify polluting industries in Agra; notices served to 511 units



September 3, 1984 | SC issues notice on petition by M C Mehta, saying pollution from units in Agra and the adjacent town of Firozabad, and Mathura refinery is a threat

1983 | Taj Mahal bags World Heritage Site tag. Centre declares Agra-Mathura region as air pollution protected area; prohibits setting up of polluting industries

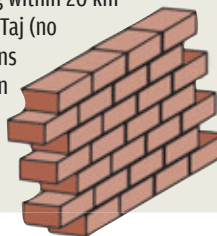
1982-83 | Mathura refinery commissioned. In two years SO₂ levels around the Taj Mahal spiral (it was noted at 859 kg/hr in 1993)

March 3, 1996 | SC orders expediting construction of bypass road to check pollution from 14,000 trucks passing through the city (road functional at present)



1996 | World Monuments Fund publishes list of 100 most endangered sites, which includes the Taj

May 10, 1996 | All brick kilns ordered to stop operating within 20 km from the Taj (no bricks kilns operate in the area now)



1996 | SC orders uninterrupted power to Agra; to expedite work on Gokul Barrage (completed in 2001) and Agra Barrage (yet to be constructed). Decides to monitor implementation of its orders



December 12, 1998 | All commercial activity in protected monuments in TTZ banned (no shop operates within the Taj premises at present)



November 11, 1998 | SC asks Union environment ministry to release funds for green belt

September 4, 1998 | Court takes note of NEERI and CPCB report on sewerage system for Agra; no pumping station allowed within 500m of the Taj

March 24, 1998 | Polluting vehicles prohibited within 500 metre of the Taj Mahal



December 30, 1996 | 292 units in Agra asked to shift to natural gas or apply for plots outside TTZ. Non-complying industries directed to be closed from April 30, 1997



August 19, 2003 | SC orders crackdown on illegal mining in Mathura as it was said to be contributing to pollution



December 2013 | NEERI prepares comprehensive environment management plan; says use of coal and biomass by units, and growth in vehicle numbers, behind the pollution

June 2013 | Agra Development Authority orders *petha* units to switch to gas fuel or relocate away from the Taj. The process is going on

January 2015 | All commercial vehicles operating around Taj ordered to shift to CNG by July 31 following an Indo-US study on the discolouration of the Taj

March, 2015 | SC pulls up Uttar Pradesh for making false claims about planting trees to compensate for trees felled for development projects





"Air quality, waste and sanitation problems are not being tackled in a systematic way"

– **Raman**, Agra resident and member of Supreme Court's monitoring committee



"Most foundry units were shut in 2001. Workers who lost jobs did not get employment benefits"

– **S M Khandelwal**, former convenor, Taj Trapezium Udyog Sangharsh Samiti

SC directions was finally brought out by two reports published by NEERI—an evaluation of TTZ projects in 2010 and a comprehensive environment management plan for TTZ in 2013. These were prepared for the Agra Municipal Corporation and the Agra Development Authority respectively and throw light on the current status of TTZ-related projects.

Emissions control: The units that were supposed to shut in 1997, as per the 1996 judgement, eventually closed in 2001. A Central Pollution Control Board (CPCB) newsletter of 2002 says that 187 units closed as a result of the order, 53 started using electricity and 42 compressed natural gas (CNG), liquefied petroleum gas or electricity. Ten factories were either not found or were not using any fuel. To monitor the gains in air quality, the court, on November 7, 2000, accepted CPCB's recommendations to set up four stations in Agra. These became functional by 2002.

Mathura Refinery: Meanwhile, the Mathura Refinery, which was the trigger for the court case, installed a hydrocracker unit in 2000, according to the website of Indian Oil Corporation, which runs the refinery. It also says that the switch to CNG was achieved in a phased manner by 2005 (see 'Order and disorder', p32).

Brick kilns: In an order dated May 10, 1996, SC had asked for closure of all brick kilns in the 20 km radius of the Taj. The May 2013 report of NEERI says 450 brick kilns in TTZ have closed operations. "Now only the registered units, which are beyond the 20 km radius of the Taj Mahal, remain in TTZ," says Nazimuddin, scientist with the small-scale industries branch of CPCB.

Agra bypass road: In the wake of SC orders on infrastructure development in 1996, the Cabinet Committee on Economic Affairs approved schemes worth ₹222.21 crore for TTZ. One part of the Agra bypass was constructed at a cost of ₹26.91 crore. The bypass is functional now. The city also spent ₹21.22 on improvement of roads.

Uninterrupted power supply: SC had put great emphasis on providing uninterrupted power supply in TTZ. The Agra authorities have implemented projects worth ₹39.09 crore for rural areas and Fatehpur Sikri and ₹9.11 crore for Agra, says NEERI's evaluation report of 2010. It also notes 27-41 per cent reduction in suspended particulate matter, 70-82 per cent reduction in concentration of ambient SO₂ and 46-74 per cent reduction in ambient nitrogen dioxide (NO₂) during 2002 to 2003 over 1996-98 levels because of improved power supply. Agra Development Authority chairperson Pradeep Bhatnagar says the city is getting 19-20 hours of power supply at present. "Round-the-clock supply is not possible because there is a general power shortage in Uttar Pradesh," he says.

Gokul barrage: Construction of the barrage in Mathura, 204 km downstream of Wazirabad barrage in Delhi, was initiated in 1990 and completed in 2001; ₹92.20 crore was sanctioned for it. The project has helped augment water supply in the region—73.5 million litres a day (MLD) water is supplied to Mathura and 282 MLD to Agra. However, NEERI's 2010 report says the quality of water is not good and the barrage has reduced the flow of water downstream, near the Taj. The report also mentions worsening of river pollution since the barrage became operational. Work

Science and sensibility

NEERI filed a complaint against *Down To Earth* for questioning the study that led to closure of Agra's small units

Supreme Court's 1996 judgement, ordering relocation or closure of 292 small industries from the Taj Trapezium Zone, relied greatly on studies by the government's National Environmental Engineering Research Institute

(NEERI) on air pollution sources that could affect the Taj. More than eight months before the judgement, *Down To Earth* (DTE) published an article that questioned NEERI's report. A complaint against the magazine was filed by NEERI with the Press

Council of India for the article. It was, however, disposed of in 45 minutes and the Council made it clear that mere criticism would not give NEERI a cause of action (see, 'Trouble over the Taj Mahal', DTE, February 15, 1998). At that time, DTE's founding

editor Anil Agarwal emphasised that reconciliation of industrialisation with environmental conservation needs good scientific advice. The magazine reiterates this point when conservation of the Taj Mahal is again at odds with the livelihood of people.

on the second barrage, 8 km upstream of the Taj Mahal, for increasing water on the stretch of the Yamuna behind the Taj has not started yet.

Solid waste management: The Union environment ministry had released ₹7.49 crore for improving solid waste management, as per NEERI's reports. Agra produces over 700 tonnes of solid waste and the reports say there is slight improvement in garbage collection, especially around the Taj, but the city does not have a sanitary landfill. The *Down To Earth* team that visited Agra found dumping and burning of garbage in open sites just outside the Taj.

Sewerage: Only 17 per cent (1,400 ha out of 8,360 ha) of the city is covered by sewerage network, says NEERI report of 2013. However, according to Agra authorities, it has increased to 30 per cent after implementation of two phases of Yamuna Action Plan and projects under Jawaharlal Nehru National Urban Renewal Mission. NEERI says 254 MLD wastewater flows through the city drains against the treatment capacity of 90.25 MLD. Only 10 per cent of sewage gets treated.

Green belt: On March 9 this year, SC stopped short of ordering an inquiry by the Central Bureau of Investigation (CBI) into compensatory afforestation carried out by the Uttar Pradesh

Flow of water and pollution in the Yamuna have worsened near the Taj since the construction of Gokul barrage in Mathura





Uninterrupted electricity supply in Taj Trapezium is essential to reduce the use of diesel generators

forest department. This happened after a court-appointed committee found that the state government had submitted wrong information about the number of saplings planted in lieu of trees cut with court's permission since 1996 for development projects. The court wanted an inquiry to ascertain if funds had been misappropriated and gave an opportunity to the state to explain. K K Singh, divisional forest officer (in charge) of Agra, says only 5,000 trees could be planted in place of 250,000 because of non-release of funds. There is no official status report on the green belt around the Taj Mahal.

Centre's cell for Taj preservation: The Court's mandate to the Centre to develop TTZ in a sustainable manner does not appear to have made much headway of late. The Union environment ministry's annual report for 2013-14 says only a token of ₹1 lakh is available for its Taj Protection Mission and

that the Uttar Pradesh government had been asked to formulate fresh proposals to seek provision of more funds under the 12th Five Year Plan. "Till date no comprehensive proposal has been received from Uttar Pradesh government," says the report.

Relocation of emporia: There are no shops or emporia functioning within the Taj Mahal premises at present but some shops on the eastern and western side remain to be shifted, according to information with A D N Rao, counsel for SC's Central Empowered Committee on forest matters.

Impact on air quality: The court-monitored actions have had a noticeable effect on Agra's air quality. According to NEERI's 2013 report, annual average concentration of SO₂ was in the range of 4-9 µg/m³, NO₂ was 18-23 µg/m³ and PM10 was 133-167 µg/m³ in TTZ between 2002 and 2010. These are below the CPCB's permissible norms for SO₂ (20 µg/m³) and NO₂ (30 µg/m³).

Emerging threat

While sulphur and nitrogen emissions in Agra may be under control, the level of PM10 is still more than double the prescribed limit. This may be because of rising number of vehicles. According to the regional transport authority data, the number of vehicles (two wheelers, cars, buses and heavy vehicles) in Agra district, has nearly tripled from about 326,000 in 2002 to over 915,000 this year. Add to this the few thousand trucks that pass through the city every day via the National Highway-2, the tourist buses and cars that bring in 20,000-odd visitors to Taj Mahal and the vehicular emissions would work out much higher. NEERI's 2013 report mentions that over 48,000 diesel generators also contribute to the city's pollution.

Anand Kumar Anand, Uttar Pradesh Pollution Control Board's (UPPCB) regional officer for Agra, admits vehicular emissions are a major source of pollution along with unorganised industries, dust, construction activities and biomass burning. But there is no way of knowing the percentage contribution of each of these. No estimates are available with either CPCB or UPPCB. What's more, the pollution control authorities do not monitor PM2.5 (particulate matter of 2.5 micron or less) in the city, which would help assess vehicular emissions.

"The second generation challenge in Taj Trapezium demands assessment of all sources of pollution and more stringent action not just around the Taj Mahal, but across the airshed of Agra and beyond," says Anumita Roychowdhury, executive director of Delhi-based non-profit, Centre for Science and Environment.

Grimy tale

Till early 2000s, ASI used chemicals for conservation without any research on their effect on the monument

The marble used in the Taj Mahal has a unique translucent quality. It is also a little delicate. Soft marble was used on purpose to facilitate inlay work and carving. It is more vulnerable to cracks and breakage, and has to be handled with care.

But back in the 1970s the Archeological Survey of India (ASI) started to routinely use chemicals to clean the marble and sandstone in the Taj. A 2006 book, titled *The Complete Taj Mahal*, by art historian Ebba Koch says the ASI had been using “ammonium and non-ionic detergents, hydrogen peroxide and triethanolamine with absorbent clay packs containing magnesium trisilicate, aluminium silicate...and with solvents like ethylene dichloride, benzene and triethanolamine” till 2002. Koch is a professor at the Institute of Art History in Vienna, Austria, and is considered a leading authority on Mughal architecture.

What is strange is that the ASI decided to use the chemicals without carrying out any research on the effects of the chemicals even when conservationists have hinted that they might contribute to the yellowing of the stone.

In 1993, OP Agrawal, former director of the National Research Laboratory for Conservation of Cultural Property, wrote in a paper published in journal *Puratattva*, an annual bulletin of the Indian Archaeological Society, that not just pollution, but several other factors were also responsible for the discolouration of the monument and that controlling pollution alone would not help. The paper says that at least one of the chemicals used to clean the Taj, polymethyl methacrylate, was responsible for yellowing. It was used to wash the western garden-wall pavilion and east and west walls. The chemical is a preservative which is transparent while applying, but turns yellow later. Nilabh Sinha, head of the Material Heritage Division of non-profit Indian National Trust for Art and Cultural Heritage (INTACH), says polymethyl methacrylate may have been in vogue during the 1990s and early 2000s. ASI officials claim they no more use harsh chemicals. ASI, however, is tight-lipped on why chemicals were used in the first place and when were they stopped. Officials are also silent over whether the chemicals deteriorated the monument. A 2008-09 booklet of ASI's science branch in Agra states the agency used chemicals to remove accretionary deposits on the marble in the main mausoleum, the main arches and the ornamental screen around the cenotaph. “In many cases, wax polish was applied on the cleaned surface, followed by burnishing,” says the booklet titled *Focus on Scientific Conservation of Cultural Heritage*. The booklet, however, says ASI now uses only glycerol, cellosolve and sodium bicarbonate. “We now use fuller's earth pack (*multani mitti*) that absorbs impurities from the surface. We only add glycerol, cellosolve and sodium bicarbonate in summers to ensure that the pack does not dry out fast. It takes at least 24 hours for proper cleaning,” says an official in ASI, Agra. “Such alkaline products are usually not harmful for stones, including marble,” says Satish Pandey, faculty at the Department of Conservation at the National Museum Institute of History of Art, Conservation and Museology, Delhi. The ASI started using fuller's earth in 1984, but it was mixed with “harmful” aluminium silicate and magnesium trisilicate to remove greasy particulate matter, states the ASI booklet (See ‘Efforts to keep the Taj's glory, p38-39’).

Conservationists stress the need for more research on the conservation material used and their long-term impact. “The marble stones used on the Taj Mahal are not uniformly white and have different shades. They may react differently to chemicals and this needs to be studied carefully,” says conservation architect Ratish Nanda, who heads the India operations of the Agha Khan

Efforts to keep the Taj's glory

Four centuries of conservation

The restoration process of the Taj is almost as old as the monument. The fundamental problem with the restoration work of the monument, say experts, is that it lacks long-term planning

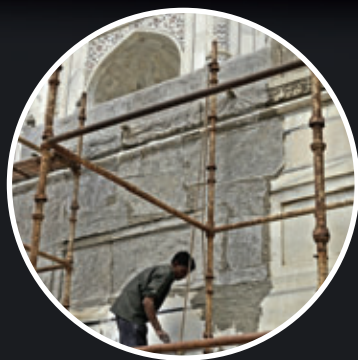
1652 The earliest record of repairs in the Taj Mahal dates back to just four years after the monument was completed. Aurangzeb wrote to his father, Shah Jahan, about leakage in the domes of the mausoleum, Mehman Khana and the mosque. Work was undertaken to flatten the surface of the roof, and to treat it with concrete and mortar.

1810 The next major repair was carried in the 19th century when Lieutenant Joseph Taylor undertook a project to clean the mausoleum. Taylor replaced missing stones in the stone inlay, which got damaged because of heavy rains, with coloured stucco.

1860 Archaeological Survey of India (ASI) was established.

1864 John Murray, the first photographer of the Taj, organised repair work of the cenotaphs, screen and interior walls that had been

How it is preserved



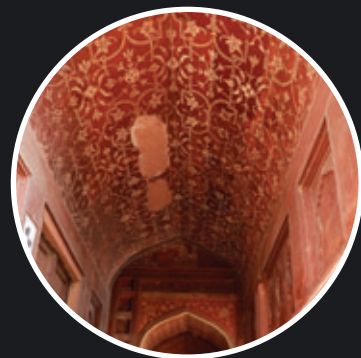
1 ASI started using fuller's earth with a mixture of aluminium silicate and magnesium trisilicate to remove tarry/greasy particulate matter in 1984. Today, ASI claims it has stopped using harmful chemicals and only adds glycerol, cellosolve and sodium bicarbonate to the mud pack in summers to ensure that it does not dry out fast.

vandalised, particularly in the first war of Independence in 1857-58.

1874 J W Alexander, executive engineer of Agra, replaced broken marble slabs, restored inlay work, made the dome watertight and regilded the finial of the mausoleum.

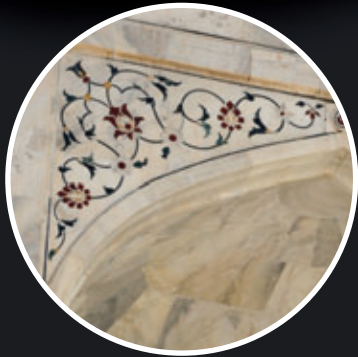
1898-1905 The first comprehensive restoration and repair work was undertaken during the time of Lord

2 An alkaline solution of ammonia is used to clean the red sandstone. ASI uses a special biocidal treatment for the sandstone portions that are hidden from sun and gather moss and algae because of humidity. Preservatives are also used to increase the longevity of the stone.



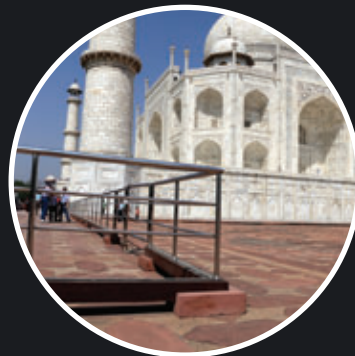
Curzon, who served as the governor-general and viceroy of India. The restoration work included not only the mausoleum and the garden but also reconstruction of the outer courts.

1983 UNESCO declared Taj Mahal as a World Heritage Site. In the same year, Union environment ministry announced the Taj Trapezium, an area spanning 10,400 sq km, which includes Agra, Mathura, Firozabad, Hathras and Bharatpur districts, to protect the Taj. The



3 Stones of the inlay work are replaced if they get damaged or broken. Earlier, artisans were chosen through a tender system. The process was discontinued after it drew criticism because the lowest cost did not assure quality work. ASI now hires artisans based on their craftsmanship, but still has no guidelines for hiring them.

4 Sandstone floors are in a more precarious condition than the marble floors because of their high porosity that locks moisture inside. As a result, the red sandstone floors are chipping at many places. ASI has put barricades near the Mehman Khana to stop visitors from stepping on them.



5 Wooden stairs have been added to decrease the pressure on marble floors and staircases and avoid wear and tear. The monument was constructed to take the weight of 30-40 people at a time. Today, over 10 million tourists visit it annually and the footfall is wearing out the walkways of its garden and the floors of its terraces.

ministry decided to keep all polluting industries outside the zone.

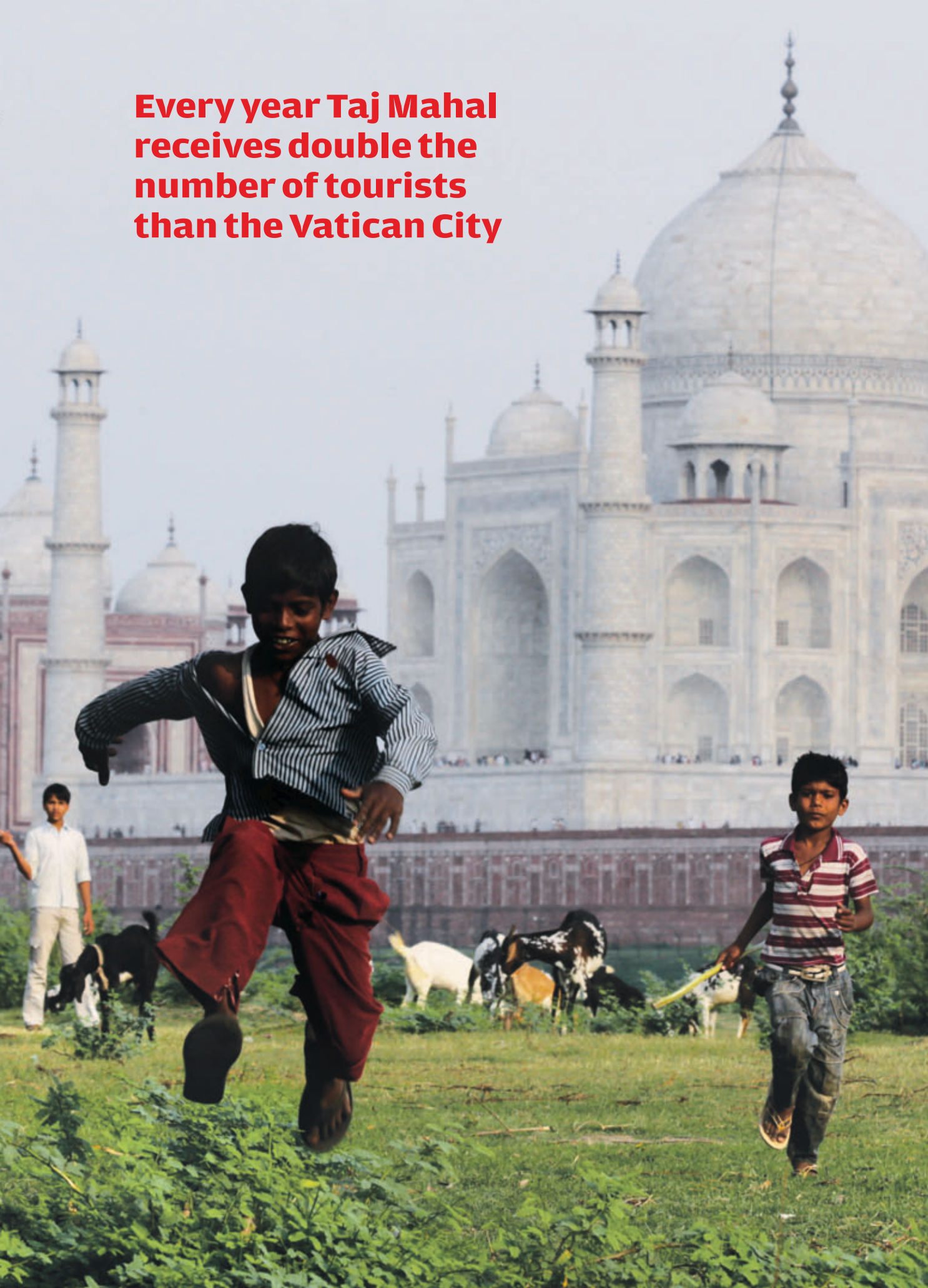
1984 ASI for the first time used fuller's earth (*multani mitti*) along with a cocktail of harmful chemicals to remove greasy particulate matter.

2001 New conservation and restoration plan initiated between Indian government and the Tata group through the Taj Mahal

Conservation Collaborative that included conservation architects, historians, landscape architects and heritage management consultant. Work undertaken to restore riverside wall, eastern enclosure wall, Fatehabad gate courtyard and Fatehpuri gate courtyard. ASI officials said after the private partner withdrew from the project, the balance restoration work was carried out by the department with money from National Culture Fund.

2014 Oil and Natural Gas Corporation signed an agreement with ASI and the ministry of tourism under Swachh Bharat Mission to beautify and preserve the monument and maintain cleanliness in the precincts. Works under the project are still in discussion stage, say ASI officials. Besides these, repair and restoration work at the Taj Mahal is taken up on a routine basis as any old buildings require high maintenance, say ASI officials.

**Every year Taj Mahal
receives double the
number of tourists
than the Vatican City**





Growth in tourism industry and construction of expressway connecting Agra with Delhi have led to manifold rise in number of visitors

Trust for Art and Cultural Heritage. “Even the effect of water needs to be checked before used for cleaning,” says Pandey. Amita Baig, who worked with the Taj Mahal Conservation Collaborative, says ASI should also focus on red sandstone that is highly porous and prone to weathering.

Visitors’ pressure

Apart from chemicals, a big threat to the Taj’s conservation is the increasing footfall. With the growth in the tourism industry and the construction of Yamuna Expressway that connects Agra with Delhi, the number of tourists visiting the monument has increased manifold in recent years. When the Supreme Court passed its judgement in 1996, Taj Mahal received 0.2 million visitors a year. It touches 10 million a year today, which is double the number of tourists visiting the Vatican City. And while the Vatican is spread over an area of 44 hectares, the Taj Mahal complex is spread over just 16 hectares. “The number is astounding when one considers that the monument was built to handle only 40-50 people a day,” says Baig.

According to the ticket sales data, the monument receives over 25,000 visitors on weekdays and over 40,000 during weekends. The actual figure will be higher because entry is free for children up to the age of 15 years. “The number increases when there is a centralised exam in the city as almost all examinees from outside the city come with family members who visit the Taj,” says Raj Kumar, one of the ASI officials responsible for managing tourists at the monument. The government earned over ₹20 crore through ticket sale in 2011, suggests ASI data.

The action of tourists’ feet wears away the stone in the pavings, floors and terraces. The presence of crowd inside the tomb chamber shoots up the humidity level. Many succeed in writing their names on the walls with felt pens, necessitating the use of aggressive cleaning substances, says Koch in her book. ASI officials admit the problem and say they are considering the recommendations submitted by the National Environmental Engineering Research Institute (NEERI) in March this year on the Taj Mahal’s carrying capacity. Tourism and Culture minister Mukesh Sharma last month said the NEERI recommendation to restrict visitors to the monument for two hours will be announced soon. But experts say the fundamental problem with the restoration work is that it lacks future planning. “We are only coping with today and not planning for tomorrow,” warns Baig.

LIVELIHOOD

Man v monument

People pay with jobs as government cracks down on *petha*-making units

Honeybees and tourists hovering in *petha* shops is a common sight across the bazaars of Agra. After Taj Mahal, Agra is famous for *petha*, candied ash gourd, sold dry, in syrup and other forms. But these juicy delights are now facing a threat.

When a recent study pointed to dust and carbonaceous particles discolouring the marble veneer of the Taj, the authorities had a knee-jerk reaction. They asked *petha*-making units within an area spread over 10,400 sq km around the Taj to either switch from using coal to LPG (liquefied petroleum gas) or shut shop, without ensuring proper alternatives.

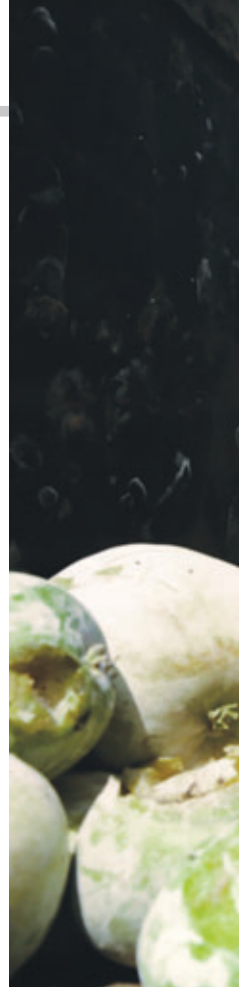
Nearly 1,000 *petha*-making units exist in Taj Trapezium Zone, according to the data with the Agra Development Authority (ADA) for 2011-12, the last time it estimated the number. According to a December 2013 report by ADA, titled *The Comprehensive Environmental Management Plan for Taj Trapezium Zone Area*, the average wood consumption in each *petha* unit is five kg per day, whereas coal used is about four kg per hour. Thus, the total daily consumption of all the *petha* units is estimated to be 500 kg wood and 4.7 tonnes of coal, which emit nearly 7.5 tonnes of CO₂ a day. This is equivalent to the CO₂ emission by three diesel-run SUVs in a month.

The manufacturers have applied for an LPG line. "But we have been told that it will take eight months. How can we stop work for so long? We'll lose all the trained workers," says Shanu Yadav of Noori Darwaza Petha Union. "This will adversely affect the *petha* industry for a long period."

Many workers have already lost their jobs. Shankar Lal, 46, had worked in the industry for 22 years. "I was earning ₹9,000 a month till two months ago," he says. Now Lal is working as a daily wage labourer in the fields of Khanda village, earning a maximum of ₹2,000 a month. Over 800 people have been rendered jobless in the village, which is just 40 km from the Agra city.

Raju Yadav, 22, and his father Bachchu Singh, 52, were also rendered unemployed by the state government's recent actions. They were working in a small *petha* unit at Noori Darwaza, the hub of *petha* making in the city. "We own two to three *bigha* of land (less than half a hectare). That is not sufficient for a family of six," says Yadav. Singh had been making the popular sweet of Agra for three decades, having risen from being a helper to a *kaarigar* (chief). He does not know where to look for a job now. Lal, Yadav and Singh worked in small units that produced 400-500 kg *pethas* a day, usually employing 15 workers. When asked about loss of livelihood caused by the crackdown, ADA officials denied it and said they were merely following the 1996 judgement of the Supreme Court which barred burning coal in a 50 km radius of the 363-year-old building.

Availability of LPG is not the only issue. "Making *petha* with LPG costs ₹5-6 more per kg. It is an inexpensive sweet; a simple preparation costs ₹40-50 per kg. Sales of those manufacturers who increased the price dipped," says Yadav of the union.



Petha makers say they will lose skilled workers because of the eight-month waiting period for new LPG connections



A worker unloads ash gourds that are dried to make *pethas*

Rehabilitation sham

ADA has a rehabilitation plan for the *petha* makers but that hardly addresses their problems. The civic authority has set up a Petha Nagari at Kalindi Vihar, some 18 km from the Taj Mahal. It has 156 plots, of which 92 have been sold, and 20-odd units have shifted there. “Even if all plots are taken, what will happen to the remaining 850 units?” asks Yadav.

Kalindi Vihar does not even have a gas connection, which was the primary reason *petha* manufacturers were asked to shift in the first place. “I shifted here five years ago after the government promised LPG pipeline. That has still not happened. I have to make *petha* at a high cost and pay extra for transport,” complains Pradeep Kumar, owner of Om Sai Petha Udyog. Their union has submitted memorandums to the state government for cheap fuel.

The site does not fulfil one primary need of *petha*-making—sweet water. The water in the area is salty. *Pethas* made in the area are not considered tasty. “We are working to bring quality water and LPG pipeline to Petha Nagari,” says an ADA official, requesting not to be named. Kumar says, “The Taj Mahal should be removed from Agra and taken elsewhere, so that people can live normal lives.”

History of high-handedness

Petha makers are not the only ones suffering. Ever since the Supreme Court passed an order in 1996 to reduce pollution in Agra and surrounding areas to protect India’s star tourist attraction, the administration’s response has been typical. It has gone about shutting industries in Agra without properly planning alternative means of livelihood and ensuring that the transition to better technology and manufacturing practices causes least pain to the people.

This has led to a sharp increase in the unemployment rate in the city. According to the 66th round of National Sample Survey Office, Agra was one of the top three cities that saw maximum increase in unemployment rate in the 2000s. The rate increased from 0.2 per cent in 2004-05 to 5.5 per cent in 2009-10. When the relocation of industries from Taj Trapezium Zone was in discussion in the mid-1990s, the city witnessed agitations. “Taj *batao*, Agra *bachao* (remove the Taj, save Agra),” shouted workers who took to the streets.

Agra was an industrial hub until the Supreme Court asked 292 units, majority of them foundries, to shift to gas fuel or relocate. Acting on the court verdict, ADA started shutting down polluting foundries and tanneries in the city. While the big foundries relocated to Etah, Firozabad and Hathras, the small ones were forced to shut shop. While the government did not assess the impact of the 2001 shutdown, foundry association members claim that over 300,000 people were directly and indirectly affected by it. Government data, however, shows only 58,000 workers were employed in the city's foundry units before the court verdict.

Twenty years on, the Jeevni Mandi area, the city's foundry hub, still has no LPG connection. The area that had over 180 units before the crackdown has only 80 units today. Babulal Verma had set up a small unit in a room in his house in Jeevni Mandi. "I could not shift anywhere else," says Verma. After his unit shut down, he started working in someone else's factory which has switched to gas as fuel. "But my sons, who were also involved with our foundry, could not find any job. Our family income reduced by one-fifth in those days," Verma says. "Workers in many foundries went back to their villages." Atul Gupta, former president of the National Chamber of Industry and Commerce (NCIC), Agra, says gas technology came to the city in 2005-06. "That was because of the efforts of the industry," he adds. NCIC is demanding subsidy on LPG in Agra.

Sullied heritage

The condition of the residents of Taj Ganj, right outside the Taj Mahal, also shows the callous attitude of the administration. In the original plan of Shah Jahan, Taj Ganj was an integral part of the Taj Mahal complex. It housed artisans, was a marketplace and had inns for travellers. Today the area is reduced to a slum.

The once thriving economy of Taj Ganj is doddering. Its resident Sanjay Kumar worked at a shoe factory till 20 years ago. His father also worked in a factory, while his mother helped with shoe-making at home. "I worked for a company which exported shoes. The factories in the area closed down and shifted to other cities. Workers were not given any compensation or rehabilitated," says Kumar. He now makes shoes in a room in his house for local consumption.

Earlier, factory used to provide the raw material and give a commission of ₹10-15 per pair. He would earn ₹2,000 a week on making 400 shoes. "Now I have to buy the raw material myself. The demand is not for more than 250 pairs a week which I sell at Hing ki Mandi market. My earning is the same as it was 20 years ago," says Kumar. His mother still helps by stitching shoes.

Taj Ganj, which should have benefitted from its heritage beginnings, faces many civic problems. In many parts, residents are dependent on hand pumps for drinking water, and groundwater in Agra is contaminated and high on fluoride. Sanitation is a big problem. "We are working on a project in which we will identify houses without toilets. Then, with the help of the government, we will fund construction of toilets," says Monu Khan of non-profit CURE International, which has been working in the area to improve health, sanitation and education. "But the final push has to come from the government for the whole of Taj Ganj," Khan says. ■

(With inputs from Shirin Bithal)

Taj Ganj, which was an integral part of the Taj Mahal complex during Shah Jahan's reign, today suffers from acute neglect



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A journey called change

Their struggle for survival and progress has shaped the understanding of environmentalism both at the national and global levels and influenced policy makers. Witnessing their achievement has become part of our journey. On our 23rd anniversary, we bring you stories of those who continue to inspire us

1 Chipko movement

It shaped pro-poor environmentalism at national and global levels as much as it influenced our founder editor Anil Agarwal, who was among the first few to write about the decade-long movement. In 1992, when *Down To Earth* was launched, he sent a correspondent to visit the villages where the movement had grown, only to find a different story ("Chipko: an unfinished mission", April 16-30, 1993"). With conservation receiving

greater emphasis, the gulf had widened between local reality and national and global perceptions. Many youth, who were part of Chipko, had started *Ped Kato Andolan* as the Forest Conservation Act, 1980, was obstructing construction of roads, bridges and electric poles in the villages. A deeper analysis of Chipko is needed to better understand true environmentalism of the poor, Agarwal warned.



They received a share of the licence fee and royalty earned from Jeevani, a product prepared using the herb. Jeevani was soon heralded as the world's first product to exemplify benefit-sharing system. It's another matter that the Kanis have not seen the benefits since 2008.

profit, Tarun Bharat Sangh, were mobilising villages in Rajasthan's Alwar district to restore traditional rainwater storage tanks, called *johads*, and to change the landscape of the desert. Today, this recipient of the Ramon Magsaysay Award and Stockholm Water Prize is regarded as one of



the "50 people who could save the planet".



2 Kani tribe of Western Ghats

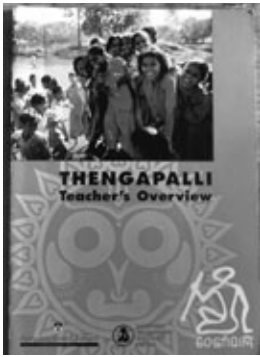
In 1998, much before the world signed the Convention on Biological Diversity, we wrote about the Kanis who asserted rights over their traditional knowledge of the wonder herb, *arogyapacha* ("How to sell a wonder herb", November 1-15, 1998).

3 Rajendra Singh

Down To Earth was the first to write about the "rain catcher" in 1993 when Singh and his non-

4 Kesharpur of Odisha

In 1992, *Down To Earth* noticed a unique movement in Kesharpur in Odisha's Nayagarh district. Every morning, two



families in the village would find batons in their frontyards which decided their day's work: guarding village forest from timber smugglers. Initiated by school teacher Joginath Sahoo, *thengapalli* movement has since inspired hundreds of villages. The movement is now included in the school curriculum of Hampshire county, UK.

5 Mahendra Singh Tikait

He rose to become the symbol of farmers' power in 1998 after he got 10,000 farmers to siege Meerut for 40 days and brought the Centre to a halt. But *Down To Earth* has been writing



about his farmers' rights movements since 1993 when he was staging rallies to oppose WTO's General Agreement on Tariffs and Trade. His political influence waned within a decade, but we kept highlighting his views on subsidies and Special Economic Zones. In 2008, when he was fighting cancer, Tikait gave *Down To Earth* an exclusive interview on India's agrarian crisis and its underlying causes, which we published in the October 1-15 issue.

6 Hardevsinh Balwantsinh Jadeja

In 1986-87, when Raj-Samadhiyala village in Rajkot district of Gujarat was declared a desert area, Hardevsinh Balwantsinh Jadeja, then sarpanch of the village, led the residents to construct 12 checkdams and 50 microwatershed projects and plant thousands of trees. The result was phenomenal. In 2000, when *Down To Earth* visited the village to gauge the impact of a severe drought prevailing in Gujarat, the wells of Raj-Samadhiyala were brimming with water. Other villages in the semi-arid region now follow its footsteps.

7 Anna Hazare

Down To Earth has been featuring

Anna since it started tracking drought in Maharashtra. Anna changed the lot of drought-stricken village Ralegan Siddhi through watershed management. In 1991, the state planned to create 300 ideal villages based on Anna's model. But the scheme could not take off due to corruption. In 1998, Anna was sentenced to three months of jail for levelling corruption charges against Maharashtra social welfare minister Babanrao Gholap.



Since then, Anna has been dreaming of a corruption-free India and we have been part of his journey.

8 Mendha Lekha

The nation came to know about this forest village of Maria Gond in Maharashtra's Gadchiroli district in 2008 when it became the first village to win



community rights over its forests under the Scheduled Tribes and Other Forest Dwellers (Recognition of Forest Rights) Act, 2006. But we have been writing about it when it started its battle against forest bureaucracy in 1992. Then we had said, "It can offer a lesson on how to run a functioning democracy."

9 Horomocho village

Four decades ago, forests of this sleepy village in Hazaribagh were depleted due to felling by the forest department and people from neighbouring villages. The residents decided to act. In 1982, they declared sovereignty over natural resources, including a coal mine, 200 hectares of sal forest, water sources and farm fields. In 2002, when *Down To Earth* visited the village, it realised their traditional gram sabha

was managing these resources well and had set up a school and a dispensary.

10 Swadhyay
Semi-religious fraternities do not really draw our attention. But when we learnt that Swadhyay, a



movement propagated by a semi-religious fraternity, promotes sustainable agriculture, checks groundwater depletion and takes care of community needs, we featured it in our magazine ("The answers within", May 16-31, 1998).

11 Koel-Karo movement
By the time *Down To Earth* was founded in 1992, tribals in Ranchi district had been protesting against Koel-Karo hydel project for 20 years. *Down To Earth* visited the conflict zone to document the longest fight against a dam in the country. The

movement eventually led to the creation of a separate Jharkhand state, with the new government ordering closure of the project.

12 Arvind Kejriwal
His struggle to bring about a change in governance had begun way back in 2009, when he would hold *mohalla sabha*, a general body meeting of the residents of an area following the concept of gram sabha. *Down To Earth* had reported about this experiment of the Magsaysay awardee and how it



brought people and authorities face to face, in its April 16-30, 2010, issue, much before Kejriwal became the chief minister of Delhi.

13 Lachen youths
In 2014, we published an initiative by 32 youths from Sikkim's Lachen village who organise clean-up drives at the end of every tourist



season. Today, it is the first village in India to ban bottled water and manage the trash left behind by tourists.

14 MYRADA
This voluntary organisation is a must stop for rural development practitioners to get trained. In 1992, its work was focussed on women empowerment through *mahila sanghas* in Tamil Nadu. Over the years, MYRADA has evolved by roping in the entire village community who prepares strategies that are creative, productive and sustainable. *Down To Earth* has been a witness to its evolution.

15 CEC
Centre for Environment Concerns (CEC), a Hyderabad-based NGO, developed a technology to assure continuous moisture supply to plants. Using the System of Water for Agricultural Rejuvenation (SWAR), many farmers in the arid Anantapur district

of Andhra Pradesh are growing orchards. We published the story in October 16-31, 2014 issue. In February this year, CEC won the Global Champion First Prize for innovation in the category of Climate Change and Forestry at the International Agriculture Exposition in Paris.

16 Shramik Bharati
Much before the Centre introduced Nirmal Bharat Yojana to provide toilet facility in each household, Shramik Bharati started helping slum dwellers of Kanpur to get drinking water, latrines and medical care. We featured its initiative in the September 16-30,



1992 issue. Today, it is a well-established NGO that works with both rural and urban people.

17 Dongria community
The heroic battle of this reclusive hill tribe of Odisha's Niyamgiri



hills hogged headlines globally in 2013 when it forced the state and the Centre, along with the judiciary, to come to its doorstep and forced mine giant Vedanta to abandon its plan of mining their sacred hills. *Down To Earth* captured this historic struggle in every detail, while documenting the self-sufficient lifestyle, rich culture of the community and their association with nature.

18 **Debal Deb**

He has been guarding seeds of over 750 rare rice varieties for about two decades. His only help are the farmers who still depend on heirloom seeds. In 2012, *Down To Earth* visited Debal Deb's hut in Odisha's Rayagada district to document how he safeguards



these unique germplasms from bio-piracy. He has inspired many across India to conserve rare seeds.

19

Sukhomajri village

In the early 1980s, this village in Haryana's Ambala district earned worldwide acclaim for the way people transformed the barren landscape. Its model of self-reliant



development attracted economists. So much so that the Prime Minister's Office started looking for the village. *Down To Earth*, through two cover stories and several articles, has tracked this village's journey from the depths of poverty to a level of prosperity.

20 **Akash Ganga Trust**

In 2002, groundwater levels were rapidly declining in Chennai. This is when the Chennai-

based citizens' action group, with the help of Centre for Science and Environment, established the country's first rain centre to promote rainwater harvesting. As more people's groups started



harvesting rainwater, we wrote about their innovative ways. A decade later, when *Down To Earth* revisited Chennai, we found that the initiatives have transformed its water scenario.

21 **Gare village**

It's rare to come across communities that oppose the Centre's decision to allocate coal blocks to private firms and float a company to mine coal beneath their land and generate power. That is what the residents of this coal-rich village are doing. To assert their rights over natural resources under their land, they have been celebrating Gandhi Jayanti as coal

satyagraha since 2013 ("People's power", December 16-31, 2014).

22 **Bharat Jan Vigyan Jatha**

In the June 1-15, 1992 issue, we wrote about Bharat Jan Vigyan Jatha (BJVJ), a people-centric scientific campaign that promotes rationalist attitude to life at a mass level. Then, its focus area was to bust the so-called miracles by explaining the scientific tricks behind it. Today, BJVJ's campaigns focus on environment, climate change and pollution-related public health.

23 **Udaipur's Seed village**

In 2002, we wrote about this village that was the true product of Bhoodan movement. It doesn't need a collector. Its gram sabha collects tax and sends to the government and manages its natural resources. Though the state amended the Rajasthan Gramdan Act, 1971, and removed section 43, which gave wide-ranging powers to the gram sabha, the village continues to remain a true republic.

PATENTLY ABSURD LATHA JISHNU

Doing very nicely without IPRs

We need to re-imagine the role of the state in creating knowledge without intellectual property rights

THE CONVENTIONAL view is that intellectual property rights (IPRs) are the best way to promote innovation. Without the rewards that IPRs such as patents and copyrights confer, there would be little incentive to innovate, goes the argument. That, of course, is not true at all. There is an interesting universe of possibilities beyond intellectual property and, as this column has argued in the past, such rights are not always the main drivers of invention.

Academia, which is actively engaged with this concept, has been coming up with interesting new concepts as the recent Yale Law School conference on Innovation Beyond IP did. Held in New Haven, US, one focus of the conclave was on the role the state can play in fostering knowledge creation and innovation outside the ambit of IPRs. There are many examples of discovery without IPRs—or in spite of it—and one case study that highlighted what the state could do in this regard was the WHO Global Influenza Surveillance and Response System (GISRS).

Established in 1952, the system has linked 138 national influenza centres, six WHO collaborating centres, several regulatory laboratories and ad hoc groups to gather data and flu virus samples. The GISRS database has been providing real time surveillance information since 1996 through its Flu Network which tracks and predicts pandemic outbreaks. It also chooses the flu strains that go into vaccines each year and plays a critical role in getting the vaccines tested by regulatory agencies.

The Flu Network was able to produce high-quality science without any recourse to IPRs. This was possible because an alternative information production system of “open science” was at work with state support. In her study titled “Bringing the state back in”, Amy Kapczynski, professor of law at Yale Law School and faculty director of the Global Health Justice Partnership, made a sharp

but unfashionable point that problems cropped up only when IPR entered the picture in recent years. In fact, they actually caused a crisis in the network which had been historically free of IPR worries.

This raises an interesting question. If the state is needed to enforce IPRs, which anyway create market inefficiencies, does it not make the state a plausible competitor to the market on efficiency grounds? Why, then, should we use intellectual property rather than the state, asks Kapczynski?

In a blog post on her study of the Flu Network, she says that the first lesson she drew is that intellectual production without intellectual property works well even in areas that are capital intensive, and that it can be as efficient as the market-exclusionary system that IPRs entail. The second key lesson is a corrective to the emerging “beyond IP” literature. “That literature has mapped many domains of creative practice that function without traditional recourse to IP (from magic to comedy to Wikipedia, for example). But it has largely ascribed creation in these contexts to norms, intrinsic motivations and new technology.”

These elements alone would not be sufficient when the stakes are high as with the Flu Network. The support of institutions and the law would be vitally important with such projects, she argues. Therefore, ideas about the role of the state would have to be recast and re-imagined. Fundamentally, what has to change is the “reflexive pessimism” about the state that is shared by both the neo-liberal, pro-intellectual property camp and their critics. For both, the image of the state is of a bureaucratic Leviathan—inert, inflexible and corrupt—although that image was disproved by its role in the Flu Network. Both sides need, and do rely upon the state. Not just on any state though, but “a capable, responsible and empowered state”. Would that it were possible! ■



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Potato test for government

The crash in potato price is triggering a wave of suicides in several states. Will the NDA government's ambitious Price Stabilisation Fund help farmers?

JITENDRA | NEW DELHI

SOON AFTER the National Democratic Alliance government announced its ambitious Price Stabilisation Fund to contain price volatility in the domestic market, the scheme faces its acid test. A bumper crop has led to a free fall in potato prices in several states this year. Between March 1 and April 4, at least 17 potato farmers in West Bengal, a major potato-producing state, committed suicide. Similar cases are also being reported from Punjab, Haryana and Uttar Pradesh. Will the Price Stabilisation Fund (PSF) be able to stabilise the market?

With a corpus of ₹500 crore, PSF has two

objectives: one, arresting crashing prices of potato and onion through procurement during bumper harvests; and two, maintaining buffer stocks of the commodities to meet demand during the lean period.

While the procurement will be done by Central government agencies like National Agricultural Cooperative Marketing Federation of India Ltd (NAFED), buffer stocks will be maintained by the state governments. For this, a revolving fund will be set up to which PSF and the state government will contribute equally (the ratio of PSF-state contribution would be 75:25 in the case of north-eastern states). State and Central



MADHU PANDIT

Stray animals eating potatoes dumped by farmers at Sanctuary Road Nabha in Patiala on April 3, 2015

market and hoard them. So it is imperative that only government agencies are roped in procurement.”

Others say the amount allocated for the fund is too little given the enormity of the problem. “Even ₹5,000 crore would prove to be minimal for addressing the scale of such problem,” says Ashok Gulati, former chairperson of Commission for Agricultural Costs and Prices. The fund would be highly insufficient in the event of a huge price crash, says the SFAC official.

“In 2006, the fourth report of the National Commission on Farmers had recommended setting up such funds to protect farmers from price fluctuations, but only for crops, such as cumin that are crucial for survival in arid areas,” says Ramanjaneyulu G V of Centre for Sustainable Agriculture, Hyderabad. It seems by setting up PSF for potato and onion—the two politically volatile commodities—the government plans to avoid fixing the minimum support price (MSP) of crops. Only MSPs of potato and onion can help save farmers, he adds.

Analysts are also questioning the timing of introducing the scheme. The NDA government had announced PSF scheme in its first budget in July 2014. It was also part of the election manifesto of the Bharatiya Janata Party. Then why did it delay rolling out the scheme? asks food and agriculture analyst Devinder Sharma. Market prices of onion and potato were high last year. This prompted farmers to increase acreage of potato and onion which flooded the market and caused the price crash, says Sharma. He alleges that the government had sensed that the prices of onion and potato would crash before it came to power.

There is scepticism about PSF’s success. “PSF will certainly protect farmers from distress selling. But the moot question is how it will be implemented,” says Gopal Naik, who teaches agro-economy at the Indian Institute of Management, Bengaluru. He cites the PSF for tea, coffee, rubber and tobacco. In 2003,

the Union Ministry of Commerce and Industry set up the PSF with a corpus fund of ₹500 crore when international prices of the commodities were declining. They were well-off farmers and it was easier for them to get help. So the scheme was a success, says Naik. “But in the present case, we do not know the exact number of affected farmers as well as the number of small and marginal farmers in the country,” Naik adds. “Besides, PSF is not a self-sustenance model where the government puts funds and the affected community manages it. We have to look at sustainable models of different countries.”

Naik cites the US as a model, where producers keep one per cent of the total sale proceeds as price stabilisation funds. They use it during distress sale with the help of the government.

Ramesh Chand, an agro-economist and director of the Centre for Social Development in Delhi, agrees that price stabilisation should not be entirely left to the government, especially for horticulture crops that are mostly farmed by well-to-do farmers. Any scheme, be it PSF or insurance, which aims at providing financial relief to growers at a time when prices of these commodities fall below a specified level, should be participatory, he suggests.

Long-term solution needed

Not all think PSF as a viable solution. Price crashes are just the symptom of a deeper malaise, points out P S Birtal, principal scientist at the National Institute of Agricultural Economics and Policy Research. “I don’t think PSF would help much. Even during distress selling of potato for ₹1 and ₹2 a kg, the market price is eight to 10 times higher. It shows there is a serious problem in the supply chain. It is time to iron out flaws existing in the supply chain instead of opting for the procuring method,” he says.

Gulati says the government should look for long-term solution to protect farmers from distress selling. “We should start linking food processing industries to farm producing organisations and encourage contract farming,” he suggests.

So, will PSF be viable for farmers? The jury is still out on that one. ■

government agencies can also draw interest-free loan to support their working capital and other expenses on procurement, storage and distribution of the commodities. According to PSF procurement guidelines, these commodities would be collected directly from farmers or farmers’ organisations at *mandis* and made available at a reasonable price to consumers during the lean period.

Analysts appreciate the price stabilisation scheme for the country’s two most volatile commodities, but sound caution.

A senior officer of the Small Farmers’ Agribusiness Consortium (SFAC), who does not wish to be named, says: “If the government floats tenders for procurement, there is a high chance that private entities would lift the commodities from the

Analysts are questioning the timing of introducing Price Stabilisation Fund. The NDA government had announced setting up the fund in its first budget presented in July 2014. Then why did it delay rolling out the scheme?

A case of ‘diminishing’ returns

Despite repeated attacks on it by science, homeopathy is the fastest growing medicine in the world today

HOMEOPATHY DOESN'T work. In fact, you are probably better off without it. This caveat comes from Australia's National Health and Medicine Research Council (NHMRC), which last month declared homeopathy as useless in treating ailments ranging from common cold to malaria.

The reviewers didn't get into the complex and rather futile debate over homeopathy's slippery theoretical foundations. Instead, they kept it simple by asking whether it really worked. This approach, called evidence-based medicine, is now a popular method of inquiry into the claims of alternative medicine.

Predictably, the finding has reignited verbal skirmishes between opposing camps. Respected British naysayers like Ben Goldacre and Edzard Ernst took the opportunity to denounce homeopathy as not only unscientific but also a con job on gullible patients and helpless taxpayers alike.

Defenders of homeopathy were quick to slam the review as biased and flawed, arguing that randomised controlled trial, the gold standard in Western medicine, treats every human being as the same when it comes to treating any given ailment. This, they argue, contradicts the very individualised nature of homeopathic treatment.

This isn't the first attempt by science to “expose” homeopathy. In August, 2005, British medical journal *The Lancet* published a cluster of studies damning homeopathy as no “better than a placebo”. However, the studies were later attacked for being biased and lacking in rigour. Again, in 2010, a study by the British House of Commons rubbished homeopathy as quackery and even recommended that the National Health Scheme (NHS) stop funding it. The government though, decided against it as homeopathy had a large following.

Homeopathy gets under the skin of scientists not just because of its mass appeal but also because it flies in the

face of scientific logic. It is founded on the belief that “like cures like” and that the more diluted the medicine (most homeopathic medicines are diluted 10⁶⁰ times in alcohol or distilled water), the more potent and effective it is. Now, this degree of dilution will render the original substance ethereal, leaving behind its “memory” or “essence”. That this ghostly presence cures the body of its many aberrations is pure bunkum, claim critics.

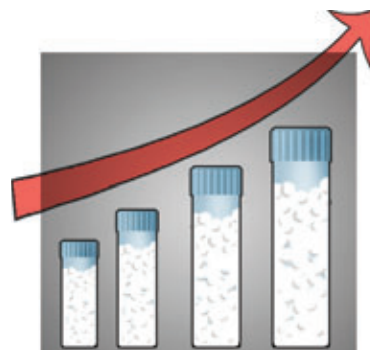
Patrons of homeopathy do concede that it is counter-intuitive. To make sense of it, they grasp at any proverbial straw, such as nanoparticles, or the sheer complexity of the healing process that can't be reduced, as modern medicine does, to a linear “A cures B” formula. Nonetheless, what matters is that it works for many. As British novelist

Jeanette Winterson wrote in *The Guardian*, “Where is the scientific sense in saying that because we don't understand something, even though we can discern its effects, we have to ignore it, scorn it, or suppress it?”

The scientific critique of homeopathy seems a tad tiresome now with both sides recycling the same old arguments. A more fascinating conundrum to mull over is how is it that millions of

people put their money in something they believe works for them but which science trashes as bogus. No ready or simple answers there. However, authors of the present review believe that their findings will at least provoke people into thinking about medical evidence, and help them judge better. Wishful thinking, given the growing public disillusionment with modern medicine.

For now, homeopathy seems to be winning. It is reportedly the fastest growing medicine in the world today, and by 2035, its projected worth would be about US \$1.1 trillion. In India alone, there are half-a-million registered homeopaths catering to 100 million patients. To paraphrase Mark Twain, reports of homeopathy's death have been greatly exaggerated. ■



TARIQUE AZIZ / CSE



Cold fish in hot water

Cold sea fish stocks would reduce as seas get warmer, shows British study



ARISE IN temperature of oceans and seas could seriously affect popular North Sea fish, such as haddock, plaice and lemon sole, which thrive in cold water. A team of British researchers have found that the North Sea, which washes the eastern shores of Britain, has warmed four times faster than the global average in the last 40 years and would warm further over the coming century. But its fish species will not be able to move northwards to avoid warming since those areas are not deep enough. As their population declines, warmer water fish from southern Europe are likely to take their place. The researchers' model used fisheries databases and climate model projects. **Nature Climate Change, April 13**

Toxic streams

A GLOBAL study of pesticides in streams and waterways states that such pollution is rare, but when found, it exceeds regulatory limits about half the time. Of the 2,500 aquatic sites covered in the study, just 2.6 per cent of the samples contained measurable levels of insecticides. At the sites containing insecticides, 52.4 per cent of the detections exceeded regulatory thresholds. In fact, the high levels of pesticide contamination constituted an excessive threat to aquatic biodiversity. **PNAS, April 13**

PHYSICS



Soil hardens when struck harder

SOIL AND sand actually get stronger when they are struck harder. Duke University researchers in the US developed techniques that enabled them to simulate high-speed impacts in artificial soil and sand in the lab. The findings help explain why attempts to make ground-penetrating missiles go deeper by shooting them harder and faster have had limited success. Projectiles experience more resistance and stop sooner as their strike speed increases, shows the research which may lead to better control of earth-penetrating missiles designed to destroy enemy bunkers. **Physical Review Letters, April 10**

HEALTH

New weapon against cancer

GENETICALLY MODIFIED *Salmonella enterica* can be used to kill cancer cells, shows a recent study. Researchers focused on modifying the lipopolysaccharide structure in the walls of the *Salmonella* strain to make the bacteria less toxic so that they would not harm healthy cells, but can effectively colonise tumours and would turn toxic after entering cancer cells. The therapy would be used in conjunction with chemotherapy and radiation once it gets to human trials. **mBio, April 14**



Can carbon-negative be the next step?

Carbon-negative technologies sequester more carbon than they release. But experts say they cannot be a substitute for reduction of greenhouse gases

INDU MATHI S

AMONG THE various strategies scientists are working on to tackle climate change, carbon-negative technologies have gained a lot of attention in the past couple of decades. As the name suggests, the technologies help reduce carbon in the atmosphere by capturing and sequestering it. But are they really effective, or even safe?

According to Pete Smith, professor at the

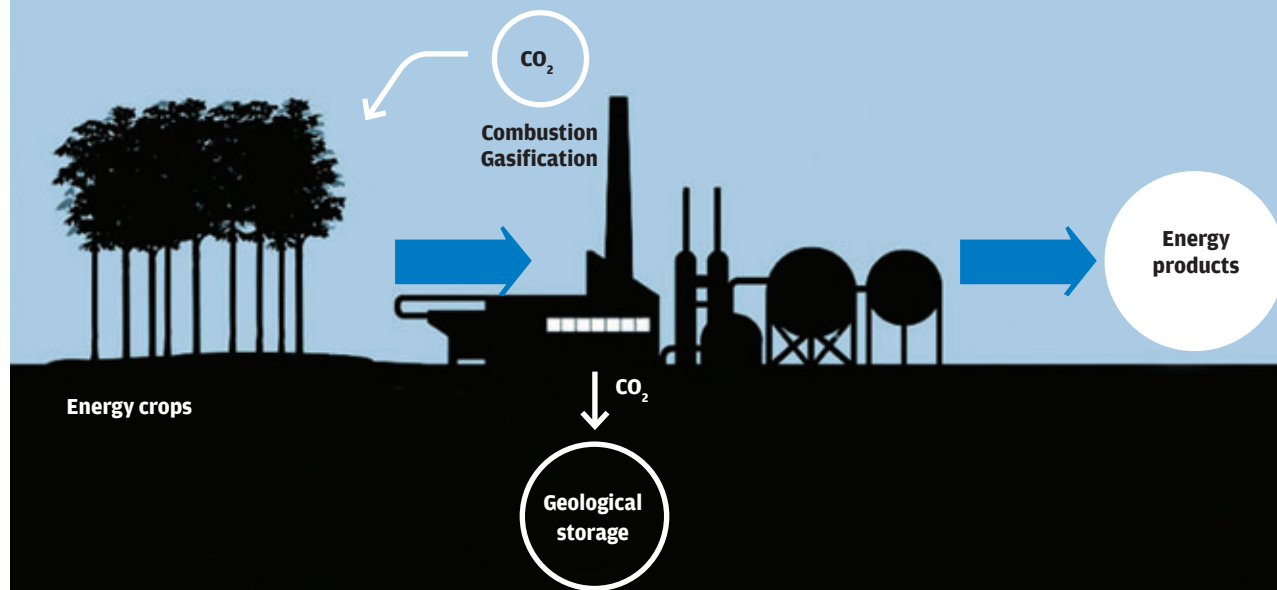
University of Aberdeen, Scotland, negative-emission technologies have been proved only theoretically in assessment models and the technologies are controversial. Relying heavily on such technologies is risky, says Smith. He gives the example of bioenergy with carbon capture and storage (BECCS), a relatively new entrant in the field of carbon-negative technologies.

In BECCS, a large quantity of biomass

(high-energy crops such as poplar, willow or temperate grasses) is burnt to produce electricity and the carbon emissions are captured and sequestered in depleted underground reservoirs or injected into porous rocks. This results in net reduction in the atmospheric carbon dioxide (see 'Offsetting damage'). The technology can be employed in power plants or other industries that make fuel.

Offsetting damage

Bioenergy with carbon capture and storage (BECCS) technology produces electricity by burning biomass. The carbon emissions are captured and sequestered underground



Source: Nature

According to a study by researchers at the University of California, Berkeley (UCB), USA, use of BECCS could make power generators store more carbon than they emit. Their study, based on a computer model of the western North American electrical power grid, says a combination of BECCS, renewable energy and fossil emissions reductions can create a carbon-negative power system in western North America by 2050, with up to 145 per cent emissions reduction from 1990 levels. The study was published in *Nature Climate Change* on February 9.

Opinions, however, remain divided over BECCS' practicability. "BECCS may sound ideal, but it has many commercial uncertainties," says Daniel Sanchez, a graduate student in UCB's Energy and Resources Group, who was part of the study. "Nevertheless, we're taking this technology and showing that in the Western United States 35 years from now, BECCS does not merely let you reduce emissions by 80 per cent but gets the power system to negative carbon emissions."

Doubts have also been raised about the safety of underground sequestration of carbon. According to a 2014 report by the Intergovernmental Panel on Climate Change, it can cause contamination of water aquifers or leak into the atmosphere. The report also said that injection of carbon dioxide in underground porous rocks can trigger tiny earthquakes which, in turn, can release the carbon dioxide.

Daniel Kammen, professor at UCB and director of the Renewable and Appropriate Energy Laboratory, where the research was conducted, has a different view. He says BECCS could be one of the few cost-effective carbon-negative opportunities available to mitigate the worst effects of anthropogenic climate change. This strategy will be particularly important should climate change be worse than anticipated, or emissions reductions in other portions of the economy prove particularly difficult to achieve, he says.

Similar technologies

Apart from BECCS, there are a few other carbon-negative technologies

Carbon curbs

Several companies have created products based on carbon-negative technologies, but doubts remain over their large-scale use

Power pallet

It is a device invented by All Power Labs, a Berkeley-based startup, that can produce gas from biomass and generates charcoal which can be used as a fertiliser. The invention is based on an over 100-year-old technology called gasification. It uses biomass such as wood chips, almond shells and corn husks to produce clean fuel. Over 500 such devices have been sold to customers who are mostly from the developing world.

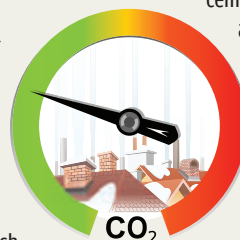
Novacem

It is a carbon-negative cement created by a London-based company which goes by the same name. Normally, cement is produced by heating limestone at high temperatures. The process emits huge amounts of carbon. But Novacem uses magnesium silicates instead of

limestone. Carbonates made from carbon dioxide and other minerals are then added to the cement, making it carbon-negative. The cement, however, is not commercially available on large scale.

Air Carbon

It is a type of plastic made by sequestering carbon emissions that would otherwise become part of the air. It is a trademarked product made by Newlight Technologies. Plastic is normally produced using oil and other fossil fuels. In Air Carbon, carbon emissions are captured from sources such as landfills and power plants and fed into reactors where enzymes react with the gases to produce the plastic. However, experts have raised doubts about the technology being carbon-negative because fossil fuels are burnt during the manufacture of the plastic.



which are being studied. Accelerated weathering of magnesium oxide-bearing rocks is one such technology in which igneous rocks containing calcium and magnesium silicates are made to react with atmospheric carbon dioxide. This results in the production of carbonates that store carbon. The technology, however, is quite expensive, costing US \$1,000 for every tonne of carbon dioxide removed, says Jen Wilcox, professor of energy resources engineering at Stanford University, USA.

Direct air capture of carbon dioxide is another example. It involves using materials such as amines, minerals and zeolites, sodium hydroxide and activated carbon to directly capture carbon dioxide from exhaust gases from industries and other sources.

Biochar, a charcoal made by slowly heating vegetation in the absence of oxygen, is yet another example. Biochar stores carbon, preventing its escape into the atmosphere. It can be used as a fertiliser but is harmful to earthworms (see 'Carbon curbs').

Reducing GHG a must

Carbon negative technologies can be used along with measures to reduce carbon emissions.

"Plan A must be to reduce greenhouse gas emissions. A failure of BECCS or other negative-emissions technologies to deliver expected mitigation in the future leaves us with no plan B," warns Smith. He also says that over-reliance on BECCS and other negative emissions system in the future, along with continued use of fossil fuel, may be extremely risky because our ability to stabilise the climate decreases with the increase in emissions.

His view is mirrored by the National Academy of Sciences which recently released a two-volume report on carbon reduction. "Strategies to remove carbon dioxide from the atmosphere are limited by cost and technological immaturity, but they could contribute to a broader portfolio of climate change responses with further research and development," says the report. ■

RIGHT TO DISSENT LATHA JISHNU

How to love farmers—the Modi way

Like its other policies, the BJP government's Land Acquisition Ordinance favours industry at the cost of farmers

I T TAKES gall to say that the land acquisition law benefits the poor. And farmers and the marginalised. But then, Narendra Modi would not be where he is if he did not have gall, and the gift of demagoguery to convince the masses that even the most regressive policies and projects of his party are either in national interest or for the benefit of the poor.

BJP's Right to Fair Compensation and Transparency in Land Acquisition, Rehabilitation and Resettlement (Amendment) Ordinance, promulgated for the second time because no other party would back the Modi government's version of it, is possibly the most detested piece of legislation in recent history. But a determined BJP even prorogued the Rajya Sabha to enable the President to promulgate the ordinance once again—all to help farmers.

Which is rather odd because the farmers are dead against it. Thousands of them have poured into Delhi at least thrice this year, camping in the capital for days on end to get the ruling party to listen to their concerns. Thousands more have rallied across the country to stop the legislation. But none of this has moved the Prime Minister or his Cabinet—we will never learn if his ministers differ with him—and it is a resolute BJP that plans on getting the ordinance through Parliament. Never mind the political opposition to it or the protests of the millions who are in one way or the other involved with agriculture.

Is this insensitivity on the part of the government? It would be unfair to say it doesn't care or respond with alacrity to the pain of the people. Its heart does bleed—for industry and the rich. Here's just one example. A few days ago, the Finance Ministry had announced that this year's income-tax returns would seek details of foreign visits made by the taxpayer along with details of the

money spent abroad. Also, the taxpayer would have to furnish the complete list of bank accounts held by him/her along with the balance in the accounts.

These are not unreasonable demands. Yet, murmurs of annoyance from the business class prompted an immediate rethink by the ministry. So the forms, it turns out, will not ask inconvenient questions in order to "simplify the process" and the rich would not need to come clean on unaccounted funds.

But on the land acquisition law there will be no retreat. After all, it is easier to bully the weak than to antagonise

the rich. Remember, it is industry that has been lobbying for changes in the 2013 Land Acquisition Act because of its restrictive provisions. Not that all was fine with the law passed by the Congress-led UPA regime. That law was not kind to the farmer, but it was tough on industry. BJP's ordinance makes the rules much kinder to industry by making them more unjust to the farmer. Three critical changes in the ordinance make it so: land acquisition no longer needs the farmer's consent; there is no need for social impact assessment for many projects; and rehabilitation is to be governed

by the 13 Acts under which the government acquires land.

Some time back, Finance Minister Arun Jaitley had declared that "governments must act with determination. They must have the desire to implement decisions". The selective determination must have been prompted by the general unhappiness of the industry lobby which, with the honourable exception of Ratan Tata, has been rather critical of Modi's inability to kick start the economy.

But never doubt that the ordinance is being brought in to help the beleaguered Indian farmer. As the prime minister said, all decisions were taken solely "for the welfare of the poor". Only "perverted minds" in the media would question that. ■



SORIT / CSE

One Week Advanced Training Program on POLLUTION MONITORING TECHNIQUES AND INSTRUMENTATION

June 22–26, 2015



Centre for Science and Environment, a non-profit organisation set up Pollution Monitoring Laboratory (PML) in 2000 to monitor environmental pollution. PML is an ISO certified laboratory with highly qualified and experienced staff that exercise Analytical Quality Control and meticulously follow Good Laboratory Practices. It is equipped with sophisticated state-of-art equipments including GC, GC-MS, HPLC, AAS, microwave assisted digestion system, PM_{2.5} & PM₁₀ analyser, ozone monitor, sound level meter, EMF radiation measurement system etc. and has facilities for microbiological analysis also.

PML has conducted several scientific studies that have brought government food standards and food safety policy changes and new regulations in India. This includes pesticides in bottled water, pesticides in soft drinks, phthalates in toys, lead in paints, antibiotics in honey and antibiotics in chicken, etc.

PML has been organising training and capacity building programmes for Central and State Pollution Control Boards for mid/senior level officers on water quality, air quality, trace metals and organic analysis. The participants get hands-on experience on the use of sophisticated analytical equipments for analysis of air, water and soil pollution parameters. The programme includes lectures, demonstrations and experiments and on latest equipments and technologies for pollution monitoring.

LECTURE CONTENT

- Sample collection, storage and preservation techniques
- Vehicular pollution and its control techniques
- Chromatographic "Finger Printing" Technique for Fuel Quality Monitoring and Analysis
- Mercury Pollution in Sonbhadra – a case study

LAB CONTENT

- Laboratory experiments on determination of pesticides, determination of heavy metals, microbiological analysis of water, field monitoring for PM_{2.5}, Ozone and Noise pollution, field monitoring of EMF radiation pollution from cell phone towers



COURSE FEE

Option 1: ₹9,000 per participant without boarding and lodging

Option 2: ₹20,000 per participant with boarding and lodging for 5 nights on double occupancy basis

Nominations are invited from Scientists/analysts working in government organisations, academic institutions, CPCB laboratories, SPCB laboratories, private sector analytical labs, EIA consultants, and students

PROGRAM SCHEDULE

Date: June 22–26, 2015

Time: 10 am to 6 pm

Venue: CSE, Core 6A, 4th Floor
India Habitat Centre, Lodhi Road
New Delhi-110003

Contact: Ramakant Sahu

Email: ramakant@cseindia.org



Centre for Science and Environment
Core 6A, 4th Floor, India Habitat Centre
Lodhi Road, New Delhi – 110003
Phone: 011-24645334/335

NOMINATION
FORM

Training on Pollution Monitoring Techniques and Instrumentation June 22 - 26, 2015

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| Name:..... | Age:..... | Phone(s): | Fax:..... |
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| Name of Organisation:..... | | Contact email:..... | |
| Brief description of present responsibilities (if any): | | What does the participant expect to learn? | |
| Office Address:..... | | | |

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TAJ MAHAL is not just a monument to beauty but also symbolises India's fight against air pollution. After almost two decades of protecting the Taj, the country must learn certain lessons on environmental protection. With each step we take to protect the world heritage monument, we make a statement of our commitment to clean the environment. Our 23rd anniversary issue dissects the environmental puzzle called Taj.

