

Current Science Reports

Assessing Pollution in the Ganga *A multi decadal study*

Since the 1960s, various initiatives and action plans have been undertaken to restore the Ganga's water quality.

Have they made an improvement, wondered a team from the ICAR-Central Inland Fisheries Research Institute in Kolkata. The team investigated the middle and lower parts of the river.

There are several sources of pollution in this stretch – domestic discharge, agricultural runoff, tanneries, distilleries, slaughterhouses, chemical factories and many small-scale industries. The researchers analysed water quality data recorded from these sites during different seasons from 1960 to 2006. The water quality index showed significant variation.

They also collected samples from 2015 to 2019 and analysed physical and chemical parameters. The lowest average value of the water quality index between 1960 and 1961 was 69. It increased to 106 during 2015–2019.

The maximum value of the water quality index observed during 2015–2019 was 126 at Varanasi, while the lowest was 95 at Patna. The researchers analysed the principal components to understand the major parameters influencing water quality.

Free carbon dioxide, conductance, total alkalinity, hardness and chloride showed positive loading while dissolved oxygen and pH exhibited negative loading in the first component, depicting the influence of human activities and associated pollution.

A statistical analysis of the water quality status revealed that the samples from Kanpur and Bhagalpur had more than 90 per cent similarity during 2015–2019.

A decadal analysis of water quality revealed that the concentration of total dissolved solids was highest while that of chloride was lowest.

The researchers also observed that the contributions of dissolved oxygen, total alkalinity and chloride were relatively less influential.

Basanta Kumar Das and team observed a gradual improvement at a few sampling sites. However, the water

quality in Varanasi has deteriorated over the years.

The researchers suggest that various mass public awareness campaigns be carried out, which could include digital and social media platforms.

DOI: 10.1007/s10661-022-10233-2

Modelling Tiger Corridors *Across the Terai-Arc landscape*



Image: Ali Arsh via Wikimedia Commons

In 2006, the tiger population in India was estimated at approximately 1400, lower than earlier assessments. Due to major changes in the tiger conservation policy that followed, by 2021, the wild tiger population increased to about 3000. The prime tiger habitat is now the Terai-Arc landscape, about 800 kilometres spread over the northern Indo-Gangetic plains and the foothills of the Himalayas.

Tigers traverse long distances to new territories to find mates. These movements depend on the roughness of the terrain and human habitations in the area. Can we identify such corridors to ensure their conservation, wondered Samrat Mondol and team from the Wildlife Institute of India, Dehradun.

To find out, between 2014 and 2018, they collected faecal samples in the dry and wet seasons for the entire tiger habitat block – around 9500 kilometres including both protected and non-protected areas. They extracted DNA from the samples to identify the species – the individual and the sex. Generating individual-level tiger genetic information helped the researchers assess habitat connectivity for the populations.

There seemed to be three tiger genetic sub-populations or blocks based on the area from which the samples were

taken. Block I had a recipient population located in the flatter southern part of the Terai region. The region also supports a large human population and includes non-protected areas. The protected areas indicated more source populations.

The team used gene flow models to estimate the rate and direction of gene flow to detect interbreeding by analysing migration patterns within each tiger sub-population using habitat connectivity as proxy.

To understand source-recipient dynamics, which describe how variation in habitat quality affects population growth or decline, the team studied the connectivity between protected areas and critical corridors using modelling.

They identified nineteen corridors. Ten were high, three medium and six low conductance for tigers. Using the geographic information system-based software, Pinch Point Mapper, the team identified narrow passages of habitats that connect two populations – bottleneck corridors. Ten bottlenecks were identified across the nineteen corridors.

'About three thousand kilometres of the habitat need immediate attention to guarantee a random mating strategy among tiger populations in the Terai Arc landscape,' suggests Samrat, Wildlife Institute of India, Dehradun.

A robust management approach is crucial for tiger conservationists to address shrinking habitats and increasing tiger populations outside protected areas for the long-term sustainability of tiger populations.

DOI: 10.1007/s10592-022-01460-8

Elephants, Gaurs, Humans *Conflicts in Tamil Nadu*

Over half of the world's elephants and nearly eighty-five per cent of the gaur population live in India. Tamil Nadu hosts a large population of elephants and gaurs. Expanding plantations and shrinking forests in the region are leading the animals to venture out in search of food and water. Reports on conflicts between humans and these megaherbivores are increasing.

Tharmalingam Ramesh and team from the Salim Ali Centre for Ornithology and Natural History, Coimbatore set

out to identify conflict hotspots in the state and to come up with appropriate solutions.

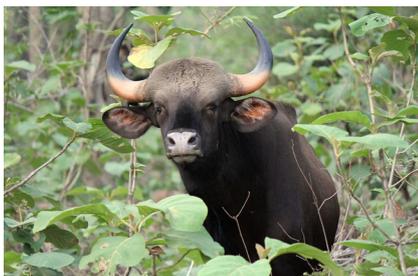


Image: Sidhesh Nimkar via Wikimedia Commons

The team interviewed about 1500 people in Tamil Nadu living in fringe areas, up to five kilometres from protected areas under 16 forest divisions.

About 45 per cent of the respondents reported conflict with elephants and 10 per cent with gaurs.

More than half the respondents reported crop damage by animals, with elephants taking the lead. Crop and property damage patterns in protected and fringe areas were similar.

Elephants consumed mostly maize, millets and bananas, followed by vegetables, sugarcane and paddy. Gaurs preferred vegetables followed by fruits, maize and coffee.

Eighty-one incidents of injuries and even deaths were reported, with more reports from protected areas than from fringe areas.

Fringe areas under the Coimbatore, Erode, Dharmapuri and Hosur forest divisions, the Sathyamangalam and Mudumalai Tiger Reserves, and the Cauvery North Wildlife Sanctuary were identified as hotspots for human–elephant conflict.

The team cross-checked the information with the Tamil Nadu Forest Department. Data was either not recorded there or not properly maintained. And there was a long delay in the compensation process.

The researchers found that crop cover, distance to nearest water source, variety of crops cultivated and the inclination of the land were the main factors driving these megaherbivores to human settlements.

They predict high human–gaur conflict under the Nilgiris, Kodaikanal, Theni, Kanyakumari and Harur forest divisions.

Restoring natural habitats and adopting biofencing to protect crops from the

animals can be a solution, say the researchers. Biofencing includes keeping bees and growing crops unpalatable to the animals – chilly, ginger, aloe and citrus.

DOI: 10.1016/j.jenvman.2022.115315

Increasing Plastic Waste Threat to Asian Elephants

In and around the forests of Uttarakhand, elephants live in close contact with human habitats. And this reflects on their diet which now includes human garbage.



Image: Aparajita Datta via Wikimedia Commons

Recently, Gitanjali Katlam from the Jawaharlal Nehru University, Delhi teamed up with researchers from Delhi and Dehradun to evaluate plastic ingestion by Asian elephants. They selected villages near the Haridwar and Lansdowne forest divisions as their study sites. These areas are elephant corridors of importance for conservation.

The team plotted transects of up to 3 kilometres, spaced from each other by at least 2 kilometres, starting from garbage dumps at forest edges towards the interior of the forest area. During the dry season, between February to June 2018, the researchers collected faecal samples from the forest interiors and from village edges near forests, and categorized these samples as forest samples and forest edge samples. They covered an area of around 273 square kilometres at the study area.

They gathered 75 faecal samples of Asian elephants, as well as faecal samples from other herbivorous animals such as sambar deer, barking deer and nilgai.

The team air-dried all the samples and analysed them for anthropogenic waste and visible plastic in the dung samples of the elephants. They found macro and microplastics as well as glass, rubber, tile pieces, wire, etc.

‘We found no plastic in sambar, barking deer, or nilgai dung. But about one third of the elephant dung sample contained plastic particles,’ says Soumya Prasad, Nature Science Initiative, Dehradun.

The team compared the amounts of plastic in dung collected from forest edges near villages with dung from forest interiors. Surprisingly, plastic particles were nearly double in faecal samples collected from forest areas than in those from forest edges. Samples collected from forest areas also contained a considerably high amount of glass, rubber bands and other anthropogenic waste.

‘Poor waste disposal and management near natural habitats is perhaps the cause of the presence of plastic in the Asian elephant’s diet. People must stop littering to protect wildlife,’ says Nirala Ramchairy, JNU, Delhi.

DOI: 10.1016/j.jnc.2022.126196

Orchards in Uttarakhand Soil nutrient status

Uttarakhand has a fragile ecosystem and less than ten per cent of the area is under cultivation. Peach and apple cultivation contributes majorly to the state’s economy. Both fruits are nutrient exhaustive. How long can the soil there continue to sustainably support peach and apple production?

Researchers from five ICAR institutes recently collaborated to investigate. In Almora and Nainital districts, they selected 14–16 year-old orchards irrigated only by rainfall, and minimally fertilised by organic manure.

The team collected soil samples from varying depths of up to 0.8 metre and analysed various physical and chemical properties of the soil. They used soil from barren fields and fallow lands as control.

They found that fruit farming in the fragile soils of Uttarakhand caused loss of subsoil nutrients. Soil nutrients tended to reduce with depth. Secondary nutrients and micronutrients were most affected. The availability of iron, manganese and copper reduced by over thirty per cent. Magnesium was depleted by over fifty per cent.

Although peach and apple trees shed leaves, adding to litter, soil carbon was lower over the control lands.

This has led to reduced soil nutrient storing potential, poor soil quality and stagnant yields of peach and apple in Uttarakhand.

Statistical analysis showed that available iron in the soil and soil pH and porosity are important factors that decide soil quality for fruit orchards in Uttarakhand.

The researchers recommend that state farmers implement adequate nutrient management practices immediately to restore soil quality and boost fruit yield. The state horticulture department also needs to provide extension services on soil nutrient management practices.

DOI: 10.1002/ldr.4402

Sandalwood Plantation *Prosopis as host?*



Image: Kavaliitt via Wikimedia Commons

Planting sandalwood saplings does not imply successful growth into trees. Sandalwood is a partial parasite and depends on the roots of other plants for initial growth. So, sandalwood plantations often yield low quantities of sandalwood oil. Optimum growth depends on a suitable host.

Sandalwood grows in semi-arid regions. So, trees that grow well in such conditions can be good hosts.

Researchers from the University of Agricultural Sciences, ICAR-KVK, and the ICAR College of Horticulture, Bengaluru recently tried to find the best host.

They studied eleven-year-old commercially grown sandalwood plants in northern Karnataka, considering perennial plants around two metres from sandalwood trees.

They recorded the distance of the hosts from the sandalwood tree. And measured the height, canopy spread, girth, the number of branches and the

thickness of recently matured leaves of the sandalwood and host plants. They also measured the growth of heartwood in sandalwood.

Statistical analysis of the data showed a better physical connection of sandalwood parasitic roots with *Prosopis juliflora*, followed by mimosa and neem. The bond with teak was weak.

The canopy spread and volume of field hosts significantly influenced the height of the sandalwood tree. *Prosopis* has a taller, broader and bigger canopy. Sandalwood canopy growth was good with neem, broom creeper, thorn mimosa and simaruba. But not with mango. The maximum sandalwood tree circumference was achieved with *Prosopis*, followed by broom creeper, neem, banni, ber and pongamia. Sandalwood heartwood initiation was also best with *Prosopis*.

Sandalwood farmers can choose *Prosopis juliflora* as a host plant.

DOI: 10.1016/j.indcrop.2022.114874

Epilepsy in Pregnancy *Outcomes in adolescents*

Epilepsy is treated with anti-seizure drugs such as phenytoin, sodium valproate and topiramate, even during pregnancy. Most babies of these mothers manifest neurological issues and congenital abnormalities during infancy. Do they also exhibit linguistic or intellectual issues during adolescence?

Dr Sanjeev V. Thomas and colleagues from the Sree Chitra Tirunal Institute for Medical Sciences and Technology, Thiruvananthapuram recently carried out a comparative study.

From the records of the Kerala Registry of Epilepsy and Pregnancy, they gathered information on 446 children, aged 13 or older, with mothers who had epilepsy.

The adolescents were made to take an IQ test. The team compared their intelligence score with that of teenagers whose mothers had not received anti-epileptic medication. The exposed group's score was much lower. But there was no discernible difference in language assessment.

The researchers gathered information from parents regarding the educational performance of such children and compared it with general data on chil-

dren in Kerala, published by the Ministry of Education. The performance was significantly lower among children of women with epilepsy. School dropout rate, frequent absenteeism and low enrolment in university education were higher.

So, there is a need to look for alternative treatments for epilepsy during pregnancy. And educators should take special remedial measures to raise the academic performance of these young people.

DOI: 10.1016/j.seizure.2022.06.005

Hypertension in Children *Comparing rural and urban*

It is expected that the prevalence of hypertension should differ between urban and rural children because lifestyle and obesity are the main contributing factors to the condition. Do children in rural and urban environments have significantly different rates of hypertension? Do these children have the same hypertension risk factors?

Anuradha Khadiolkar and team at the Hirabai Cowasji Jehangir Medical Research Institute, Pune recently looked into the issue.

The researchers collected data on 1800 children and adolescents between 3 and 18 years from five Indian states, covering village and city populations. Using a sphygmomanometer, they assessed the blood pressure of the children.

Urban children had an 8% prevalence of hypertension. But prevalence among rural children was only 4%.

The researchers also investigated the associations between various factors and childhood hypertension. They determined body mass indexes from the height and weight of the children. Other parameters like body composition and resting metabolic rate were also measured. Information from the recall of the last one day and two days nutrient and food group intake was collected and calculated. Physical activity was assessed through a questionnaire.

Obesity was more common in children with hypertension than in those with normal blood pressure. Children in urban areas were more likely to be overweight than children in rural areas. Children with hypertension had higher

sodium and calorie intake. They had lower fat-free mass and lower resting metabolic rate.

The resting metabolic rate was higher in urban youngsters than in those from rural areas.

Parents and teachers need to take action to prevent hypertension in children.

DOI: 10.1016/j.nut.2022.111759

COVID-19 Virus

Characteristics of transmission

COVID-19 virions in air samples have been reported worldwide. But where are they in greater numbers and how far do they travel?

Researchers from the CSIR-CCMB, the ESI Medical College, the Durgabai Deshmukh Hospital and the COVID-19 Nodal Centre, Hyderabad, as well as the CSIR-Institute of Microbial Technology, Chandigarh, and The Tata Institute for Genetics and Society, Bengaluru investigated. From six hospitals in Hyderabad and Mohali, they took air samples – from COVID and non-COVID ICUs, COVID and non-COVID wards, COVID rooms, OP corridors, mortuaries, and doctors' rooms.

The researchers used disposable gelatin filters and a 1000 millilitre air sampler to collect air samples at a 50 litre per minute flow rate for 20 minutes. RNA was later extracted from the gelatin membranes and viral RNA was detected using RT-PCR. Out of 80 samples from the various locations, 30 were positive for SARS-CoV-2 RNA.

How far away can SARS-CoV-2 be detected in the air and for how long?

To check, the researchers analysed air samples at different distances from infected individuals occupying a closed room for a short time. The virus was present in 5 of 17 samples. The virus was also detected after the infected individuals left the room.

The researchers also collected air samples from the rooms of home quarantined patients. Samples collected at 1.5 and 3.5 metres from infected individuals were positive for the virus. The researchers also found that some air samples were positive even two hours after the infected person left the room.

The results indicate that, in closed settings, SARS-CoV-2 can stay in air for longer durations. They also provide evidence of the long distance transport of the virus through air. Health workers can use this information to educate the public on how the virus spreads through the air and advise physical distancing and masks.

DOI: 10.1016/j.jaerosci.2022.106002

Short-term Hypergravity Effects on zebrafish embryos

Near weightlessness or microgravity during space travel affects blood circulation. Anaemia, platelet deficiency and abnormalities in the structure of red blood cells are common among astronauts after long-duration space missions. Hypergravity, where the force of gravity is higher than that of the earth, can be created using a centrifuge machine. Can such artificial hypergravity help us overcome the ill effects of microgravity during space travel?

Recently, Senthil Kumar Hariom and Everette Jacob Remington Nelson, from the Vellore Institute of Technology, investigated the effects of short-term hypergravity on the embryonic development of the blood cells and blood vessels in zebrafish, a model organism.

Aquatic organisms experience buoyancy to partly counteract gravity. So, zebrafish are sensitive to even small changes in gravity. The researchers centrifuged zebrafish embryos to three times the earth's gravity for two hours. The temperature was maintained at 24–

26 degrees Celsius to protect the embryos from thermal shock.



Image: OSU via Wikimedia Commons

The researchers selected different stages corresponding to key events of zebrafish embryonic development to analyse spatial and temporal changes in gene expression by real-time PCR and whole-mount *in situ* hybridization. The embryos showed enhanced gene expression patterns during both hematopoiesis and vasculogenesis as an adaptive response to hypergravity.

The researchers compared the morphology, body length and mortality of short-term hypergravity-treated embryos with those of control specimens and found no anomalies.

'The findings increased our understanding of the influence of hypergravity on specific aspects of vertebrate embryonic development,' says Everette Jacob Remington Nelson, Vellore Institute of Technology.

Cardiovascular deterioration in astronauts pursuing futuristic deep-space missions will perhaps be counteracted with artificial hypergravity.

DOI: 10.1016/j.lssr.2022.05.005

Reports by: **Ankita Saha, M. S. Induja, T. Anju Philip, Sileesh Mullasserri, Shwetakshi Mishra and Sheikh Aneaus**

ACKNOWLEDGEMENT: NCPOR, Goa for access to scientific databases.

scienceandmediaworkshops@gmail.com