

‘Air pollution does not discriminate; it impacts everyone’

Pema Gyamtsho, director general of Nepal-based International Centre for Integrated Mountain Development (ICIMOD), shared his views with Porimol Palma of The Daily Star on the challenges and potential solutions to air pollution during a workshop in Nepal in late November.

According to a Lancet report this year, Bangladesh recorded 225,000 deaths linked to air pollution in 2022. The situation is similar in other South Asian countries. Could you tell us more about this?

We cannot attribute all deaths directly to air pollution because it is not like someone shooting another person. Air pollution kills gradually, often in combination with other factors. However, it is one of the leading causes of mortality, including premature deaths. In South Asia—one of the most polluted regions in the world—air pollution is a major cause of premature deaths and illnesses such as tuberculosis, cancer, and more. It also impacts quality of life; people with respiratory diseases suffer constantly. Statistics from Nepal indicate that air pollution reduces the average life expectancy by three to four years. This is likely true for many countries in the region.

Air pollution also creates social and psychological impacts—schools close, children remain indoors, flights are disrupted, tourism declines, and businesses sometimes shut down because people cannot go outside. Seasonal pollution from wildfires and the burning of crop residue can be severe and cause major economic damage. Pollution also harms agriculture; plants covered in dust or black carbon cannot photosynthesise properly.

What are the main causes of air pollution in this region?

At the household level, many families still lack access to clean cooking energy. They burn firewood, biomass, or even dried dung, especially at high altitudes. Indoor cooking is a major problem, with many remote homes having poor ventilation. In urban centres such as Kathmandu, Delhi, Dhaka, and Karachi, the transport sector is a significant contributor, particularly through fossil fuel use. Industries, including brick kilns and cement factories, emit large quantities of fine

particulate matter like PM2.5. Workers in these sectors are among the most vulnerable. Wildfires, whether deliberate or accidental, particularly in March and April, also significantly degrade air quality. These are some of the principal causes.

Many of these factors are related to the economy. We cannot shut down industries or transport immediately. Where can we begin?

It's true, we cannot halt these overnight, but we must find ways to address them. Some issues are behavioural. For example, people still burn rubbish even when waste collection services are available. These practices can be changed. There is a significant shift towards electric vehicles, but we need to go further. Cities like Kathmandu and Dhaka should prioritise developing public transport systems, such as electric buses or trams. Individual electric vehicles alone will eventually congest roads. Countries like Nepal and Bhutan have abundant hydropower and should invest in clean, mass transit options. Electricity is available for clean cooking, but cost remains a challenge for poor households. Governments must prioritise subsidising clean cooking technologies; many still rely on kerosene or other fossil fuels. Public transport subsidies, cleaner industrial technologies, and affordable solutions are vital. Technology exists—in Nepal and Pakistan, brick kilns have successfully been converted to ZigZag technology, reducing black carbon emissions by around 60 percent and carbon dioxide by about 50 percent. Bangladesh is also promoting this. We need to expand these initiatives.

Pollution is transboundary. For example, polluted air blows from Punjab and Lahore into Bangladesh. How should we address this?

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Pema Gyamtsho

linking emission sources to their final sinks across regions. That's why we are working across the Indo-Gangetic plains, Himalayas, and foothills, bringing together Pakistan, India, Nepal, Bangladesh, and Bhutan for real-time data sharing. We need standardised monitoring, measurement, and modelling systems so that data collected in Kathmandu can be understood in Bhutan or Bangladesh. Our monitoring working group, starting in 2022, is developing this capacity.

What progress have you made over the past two years?

We have made significant progress. The first step was recognising that air pollution requires a regional, transboundary approach because air does not respect borders. In December 2022, we held a stock-taking conference with reports from all countries and developed the Kathmandu Roadmap for Air Quality Improvement, supported by the World Bank and other partners, such as the

UK Foreign, Commonwealth & Development Office (FCDO). We identified key stakeholders and shared best practices. In 2023, in Thimphu, Bhutan, we held the second science and policy dialogue, involving banks and the private sector. One key recommendation was to include finance in the strategy. Now, we have a science, policy, and finance dialogue, and three thematic working groups focused on monitoring, solutions, and investment. We are also planning a fourth group on communication to connect all stakeholders.

Cooperation at the regional level often faces fragmentation. How do you see this cooperation evolving?

We must be opportunistic. Air quality is one of the least politically contentious issues in the region. Everyone recognises its profound impact on health, environment, climate, and economy. This consensus provides a strong

foundation for cooperation. Scientists are already collaborating, and policy officials are engaging as well. The next step is political commitment, but progress is steady.

First, we must help ourselves. If developed countries see us taking action, they are more likely to support us. Waiting passively for aid won't lead anywhere. Countries like India and China are investing heavily in renewable energy and electric mobility. Nepal has one of the highest per-capita electric vehicle use, and Bhutan and Nepal are rich in hydropower. These examples reflect commitment. Historically, developed nations have moved many polluting industries to our region, cleaning up their own backyards. Now, they need to support us in cleaning ours. This isn't begging—it's justified. Their support should focus on technology transfer, affordable clean technologies, targeted investments linked to emission reductions, and measurable outcomes. We must demonstrate our own commitment and provide evidence of progress.

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You emphasise communication. How can the media contribute?

We want the media to be a key partner. Scientific data needs to be translated into policy, practice, and public awareness. Journalists can communicate in local languages and accessible formats. The media should act as a bridge between science, policy, and communities. That's why I propose including communication as a key pillar in the dialogue on air pollution.

How agricultural innovations can feed a nation and keep emissions low



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For five decades, Bangladesh's agriculture has powered food security and rural livelihoods, yet climate change now threatens that success. Average temperatures have risen by 0.24 degrees Celsius per decade since 1981 and could climb another 1.5–2 degrees Celsius by mid-century according to Bangladesh Meteorological Department (BMD) and IPCC's Sixth Assessment Report (AR6). Rainfall is erratic, groundwater is declining, and salinity, drought, and flash floods increasingly converge. My own analyses across Bangladesh Rice Research Institute (BRRI) research stations show rice yields could fall by 15–20 percent unless irrigation, fertiliser, and varietal strategies are re-engineered for resilience.

The data are sobering, but they also reveal how transformation is possible. Over the past decade, field trials in Gazipur, Rajshahi, and Satkhira prove that a portfolio of low-carbon agronomic practices—Alternate Wetting and Drying (AWD), Direct Seeded Rice (DSR), short-duration stress-tolerant varieties, and the locally fabricated Prilled Urea Applicator (PUA)—can simultaneously raise yields, conserve resources, and cut greenhouse-gas emissions. As documented in an article in Rice Today, these innovations show that Bangladesh can pioneer climate-smart intensification: producing more rice with less water, energy, and carbon.

Precision water, smarter nitrogen

The irrigation method AWD is one of the most promising interventions for rice cultivation. In Bangladesh, multi-location experiments during 2018-19 found that AWD reduced cumulative methane (CH₄) emissions by approximately 37 percent compared to continuous flooding, while grain yields were unaffected. Meanwhile, global meta-analysis indicates AWD reduces CH₄ emissions by approximately 51.6 percent and global-warming-potential (GWP) by almost 46.9 percent, though nitrous oxide emissions increases by 44 percent. The broader water-saving potential of AWD is supported in Bangladesh: pilot work reports water savings of approximately 25-30 percent in regions where farmers pay volumetrically for irrigation. However, widescale adoption

remains constrained by three critical enablers: reliable electricity for pumps, disciplined scheduling of dry-rewet cycles, and transition to volumetric water billing instead of flat per-area charges. Without these enablers, AWD's full potential will remain restricted to demonstration plots rather than scaling across the national rice landscape.

The second innovation DSR replaces labour- and fuel-intensive puddled transplanting and has been shown to reduce methane emissions by up to 47 percent and save both diesel and groundwater. Yet its national adoption rate remains below 10 percent. At pilot sites in Rajshahi and Bogura, DSR plots reduced irrigation cycles from 10 to six, but weed management and lack of mechanised seeding remain major constraints. Without affordable seed drills and technical guidance, most farmers are reluctant to risk an entire season's harvest.

A third frontier in rice-sector innovation is genetic adaptation. Short-duration and stress-tolerant varieties, for example, BRRI dhan74, BRRI dhan81 and BRRI dhan84 (maturing in about 120–135 days), allow farmers to escape late-season heat or flood damage. Coastal strains such as BRRI dhan97 and BRRI dhan99 have been developed for high salinity environments. Meanwhile, submergence-tolerant varieties such as BRRI dhan51 and BRRI dhan52 have demonstrated survival for up to two weeks under water. When these genetic tools are integrated with irrigation practices like AWD or DSR, there is a dual benefit—mitigation (via reduced flooding duration) and adaptation (via risk avoidance).

Finally, the PUA exemplifies Bangladesh's capacity for frugal, high-impact innovation. Developed by BRRI engineers and refined through field trials I have supervised since 2016; this lightweight device delivers prilled urea precisely to the crop's root zone. It enhances nitrogen-use efficiency by around 30 percent, cuts nitrous-oxide emissions by 10–20 percent, and typically boosts rice yield by about 10 percent. Considering that rice cultivation uses roughly 25 lakh tonnes of urea annually in Bangladesh, nationwide deployment of the PUA could reduce

fertiliser demand by nearly 7.5 lakh tonnes each year—saving over \$300 million while simultaneously lowering import costs and agricultural greenhouse-gas emissions.

From relief to resilience finance

Technology is not the main barrier in adopting these practices, finance and governance are. Farmers rarely profit from saving water, face frequent power outages, and lack credit for mechanisation. Although

labour hours. Digital advisory tools—Khamari App, Krishoker App, and e-Krishi—further improve decision-making and credit access. Embedding gender and youth indicators in national monitoring systems will ensure that participation is measurable and rewarded. For instance, the Khamari App's recommendations led to about 18 percent reduction in fertiliser cost and about six percent yield increase in Boro trials.



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Smart irrigation and nutrient management can halve the climate penalty on rice yields.

agricultural lending has grown (with a target of Tk 380 billion in FY 2024-25), climate related allocation to 25 ministries in FY2026 was lower than the previous fiscal year.

What we need is National Risk Mitigation Facility—a blended fund pooling government, banking, and donor capital to underwrite climate-smart loans and weather-index insurance. A linked digital finance dashboard between the Ministry of Agriculture and Bangladesh Bank could track every climate-smart agricultural (CSA) loan against hazard maps and gender inclusion metrics. Such integration would turn resilience data into bankable collateral.

Lightweight mechanisation reduces women's labour burden, while youth-run service hubs are emerging as viable enterprises. Female farmers using the PUA reported saving roughly one-third of fertiliser

Evidence from the climate frontline

Crop-modelling simulations project that Boro yield can decline by about five percent by 2030s and 20 percent by 2050, with smaller but significant losses for Aman and Aus. Combining AWD, stress-tolerant varieties, improved drainage, and staggered transplanting can recover 10-15 percent of these losses. In short, smart irrigation and nutrient management can halve the climate penalty on yields.

But Bangladesh is not uniform. The Barind uplands face heat and drought; the haor basin suffers flash floods; coastal deltas battle salinity and cyclones; and southeastern hills erode under heavy rain. Each landscape requires a tailored CSA “menu”: heat-tolerant rice with micro-insurance in the Barind, drainage and submergence-tolerant cultivars in the haor, salt-tolerant varieties with solar

drainage in the coast, and agroforestry in the hills. One policy cannot fit all.

Five strategic measures can help tackle the challenge. First, ensure that climate and satellite datasets from the BMD and Bangladesh Space Research and Remote Sensing Organization are publicly available. Open data will empower financial institutions, insurers, and researchers to quantify risk, design climate-linked credit, and verify carbon-saving outcomes across agriculture. Second, integrate verified efficiency and mitigation indicators—such as AWD, DSR and PUA—into the agricultural credit scoring framework of the Bangladesh Bank. Linking finance to verified resource efficiency will reward innovation and accelerate low-emission farming. Third, introduce performance-based incentives that pay farmers per tonne for carbon-dioxide-equivalent reduction through climate-smart practices such as AWD, DSR, or mechanised fertiliser deep placement. A digital finance dashboard jointly managed by the Ministry of Agriculture and Bangladesh Bank could automate these payments and ensure transparent tracking. Fourth, expand concessional credit and capacity-building programmes for women mechanisation entrepreneurs and youth-led agritech ventures. Digital tools like e-Krishi, the Khamari App, and Krishoker Janala demonstrate scalable pathways to enhance financial inclusion and technology access and lastly, build a unified monitoring, reporting and verification (MRV) framework that links agronomic data from the Department of Agricultural Extension (DAE) with financial data from the Bangladesh Bank. This system will align agricultural performance measurement with national adaptation and mitigation priorities outlined in the National Adaptation Plan 2023–2050 and the Bangladesh Delta Plan 2100.

Also, traditional metrics—tonnes per hectare—must give way to emissions per tonne and resilience per taka invested. When every subsidy or credit line carries a climate-performance tag, Bangladesh can shift from counting inputs to accounting for impact. That transparency will unlock green finance and link local adaptation to global mitigation.

Bangladesh has policy blueprints, but integration is slow. What's missing is a unified delivery system connecting climate data, finance, and field adoption. Success will hinge on institutional coordination and the courage to move from demonstration to delivery. If that resolve is found, Bangladesh's rice fields could become a global example, proving that innovation, inclusion, and investment can align to feed a nation, while keeping carbon emission minimal.