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5th June 2025



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The Hindu Analysis June 5th 2025

Topics Covered

- **Exposomics for better environmental health**
- **Aiming for an era of 'biohappiness' in India**
- **Empowering women in green business**
- **The seeds of sustainability for India's textile leadership**
- **Has the environmental crises in India exacerbated?**

World Environment Day

Theme: **Beat Plastic Pollution**

Date: **June 5**

Host : **Republic of Korea**



Exposomics for better environmental health

GS Paper 2 – Governance, Social Justice and Health

GS Paper 3 – Environment & Technology

GS Paper 4 – Ethics Ethics in Public Health and Environmental Justice

Exposomics for better environmental health

The focus for World Environment Day in 2025 (June 5) is on ending plastic pollution. Micro-plastics represent one of the many thousands of chemical, physical and biological hazards that lurk in the air, water and living spaces for which we have neither the sensory capabilities nor sensing technologies to measure exposure and assess health risks. Thus, reducing the environmental disease burden continues to be a daunting challenge for public health.

In India, rapid economic growth is increasing the scale and the complexity of environmental exposures and the interdependencies between the living environment and lifestyles. With India already accounting for nearly 25% of the global environmental disease burden, there is a need to develop newer paradigms for environmental management that rest on integrated health risk assessments.

These must include all environmental factors into the study of disease development. The piece-meal approaches that define our current framing on environment or health indicators are likely to exaggerate environmental health inequities and result in spiralling health costs. We must embrace new and cutting-edge scientific developments in the field of "exposomics" to gain a more complete picture of disease etiologies over the life course and develop holistic prevention strategies. Strategic investments in long-term environmental health surveillance that integrate novel environmental and biomonitoring efforts with digital health and data science platforms are critical.

Environmental disease burden

The World Health Organization (WHO) began estimating the environmental disease burden in 2000, which is the basis for the modern estimation approach being adopted in the Global Burden of Disease, Injuries, and Risk Factor (GBD) study. Each cycle of the GBD identifies risk factors with the greatest attributable health burden. In the latest cycle (2021) that included 88 risk factors, environmental and occupational (OEI) risk factors in the GBD were responsible for 18.9% (12.8 million) of global deaths and 14.4% of all disability-adjusted life years (DALYs), led by ambient PM_{2.5} air pollution (4.2% DALYs, 4.7 million deaths) and household air pollution from the use of solid fuels for cooking (3.9% DALYs, 3.1 million deaths).

In India, nearly three million deaths and 190 million deaths are attributable to occupational and environmental health (OEI) risks. OEI risk factors in India are also estimated to account for more than 50% of the attributable burden for non-communicable diseases including ischemic heart disease, stroke, chronic obstructive lung disease, lung cancer, asthma and, more recently, diabetes and chronic kidney disease. Risk factors such as lead exposures can have grave developmental health impacts for children under five, with India accounting for up to 154 million or 20% of the total estimated IQ points lost globally in children under five.

What are we missing? The GBD results provide



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Scientific developments in the field of exposomics will also help get a better picture of disease etiologies and craft holistic prevention strategies

a strong and robust body of evidence to initiate actions for cleaner air, safer water and better sanitation. However, the current environmental burden of disease addresses only a limited number (around 11) of categories of environmental risk factors as there is a paucity of human exposure data. Several environmental risk factors that can contribute to significant health burdens are currently not included in the GBD. These include various chemical exposures, risks from complex mixtures such as micro-plastics and solid waste and physical hazards such as environmental noise.

More importantly, environmental risk factors interact in complex ways with metabolic (high blood pressure or high fasting plasma glucose) and behavioural risk factors (smoking and unhealthy diets) as well as underlying genetic susceptibility and upstream health determinants (such as socio-economic status) to produce a health impact within populations. Risk estimates are often derived for single risk factors; while confounding is often well adjusted in long-term cohort studies, complex mixtures and interactions over a life course have not been adequately explored.

Finally, climate change can magnify hazards posed by multiple environmental risk factors, such as heat, air pollution, vector-borne diseases, storms and flooding, and wildfires. Climate change may reduce crop yields, reduce agricultural worker productivity, disrupt food security and affect food supply chains. Depression, anxiety and other mental health outcomes, driven by both ecological concerns and direct health impacts of climate-sensitive environmental risk factors such as fine particulate matter, are also important to consider. Several of these risk factors can occur together, resulting in compound events and synergistic effects. These hazards can further amplify health impacts among populations with inadequate access to health systems or healthy food systems. Methods and data are not yet available to support inclusion of these important risk factors in the global burden of disease assessments.

Thus, the current environmental burden of disease estimates are not only a conservative underestimates but also do not provide an adequate means of prioritising against competing risk factors to develop holistic, scalable preventive health strategies.

The human exposome

The global human genome project (1990-2003) revolutionised our ability to explore the genetic origins of disease. However, it also revealed the limited predictive power of individual genetic variation for many common diseases. Genetic factors for example, contribute to less than half of the risk of heart disease, which is a leading source of mortality.

The success in mapping the human genome has fostered the complementary concept of the "exposome". The exposome is defined as the measure of all the exposures of an individual in a

lifetime and how those exposures relate to health. Traditional environmental health studies include hypothesis-driven methods which have focused on one or a class of environmental exposures at a few time points. These fail to account for the complex interactions of exposures across the lifespan, on human health.

Exposomics aims to bridge this gap by understanding how external exposures from physical, chemical, biological and psycho-social environments interact with diet and lifestyle and internal individual characteristics such as genetics, physiology, and epigenetics to create health or disease. This would allow the generation of an atlas of exposure wide associations (EWAS) to complement genome-wide associations (GWAS) and enable discovery-based analysis of environmental influences on health. The exposome requires synchronisation of several inter-disciplinary technologies which

include real time sensor based personal exposure monitoring with wearables; untargeted chemical analyses on human biomonitoring samples; testing on human-relevant micro-physiological systems (also known as organs-on-a-chip)

wherein in vitro models replicate the structure and function of human organs or tissues to understand the mechanistic basis of biological response; and big data, and artificial intelligence (AI) to mine data and generate integrated pieces of evidence.

Given that capacities and resources to generate exposomics data are not widely available, an immediate need for the exposomic framework to become a reality is also the creation of a data ecosystem in which harmonised data can be found, accessed, and shared through sustained and interoperable data repositories.

Mainstream environment within health

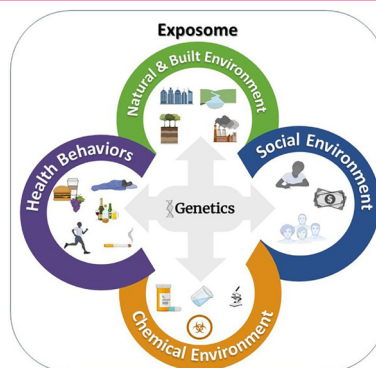
Exposome frameworks may seem implausible or irrelevant in India where the implementation of environmental health management programmes faces numerous hurdles. But, leapfrogging to technology and data-driven approaches is not new to the health sector. Exposomics offers unprecedented potential to mainstream environmental risks within public health programmes by generating more accurate predictive models for many chronic diseases while also enabling precision medicine. Unbridled investments in capacity building and synchronising available analytical, environmental and public health infrastructure offer the promise of addressing the concerns of our populations with unprecedented cost-effectiveness. The time is ripe for the Indian environmental health community to engage and contribute to the global momentum on the science of exposomics.

Future celebrations of World Environment Day may soon focus on why the human exposome project can be the best prescription for holistic prevention efforts that preserve and promote health equity.



Key points from article

- **Limitations of Existing Health Risk Assessments**
 - ♦ GBD (Global Burden of Disease) 2021 includes **only 11 environmental risks**.
 - ♦ Fails to account for **complex mixtures** (like microplastics), **noise**, **climate-induced hazards**, and **interacting risk factors** (socio-economic, behavioral, genetic).
- **The Concept of Exposome and Exposomics Complementary to the Human Genome Project.**



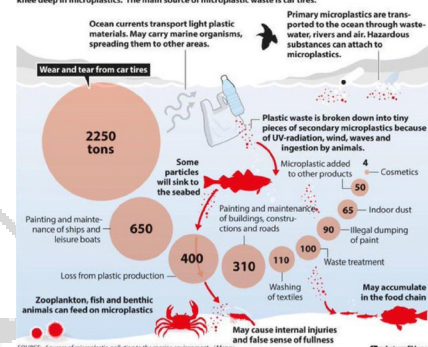
- Defined as the totality of all environmental exposures across an individual's life and their effect on health. Uses **Exposure-Wide Association Studies (EWAS)** to complement **Genome-Wide Association Studies (GWAS)**.
- **World Environment Day 2025 Theme** *Ending plastic pollution*, with a focus on **microplastics** as one of many unmeasured environmental hazards.
- **India's Environmental Disease Burden**
- Accounts for **25% of global environmental disease burden**.

Microplastics



We are filling our oceans with microplastics

Approximately 8000 tons of primary microplastics are generated annually in Norway. About half will end up in the ocean. If 8000 tons of microplastics were dumped in downtown Bergen, its citizens would stand knee deep in microplastics. The main source of microplastic waste is car tires.



1. OEH (Occupational and Environmental Health) risk factors in India:

Cause ~3 million deaths.

Affect **100 million DALYs**.

Contribute to **50% of non-communicable disease burden** (heart disease, stroke, asthma, CKD, diabetes, etc.)

2. Lead exposure alone accounts for **154 million IQ points lost in children under five** globally, with India contributing 20%.

Technological Requirements of Exposomics

Wearable sensors for real-time exposure monitoring.

Untargeted chemical analysis in human biomonitoring.

Organs-on-chips (human-relevant microphysiological systems).

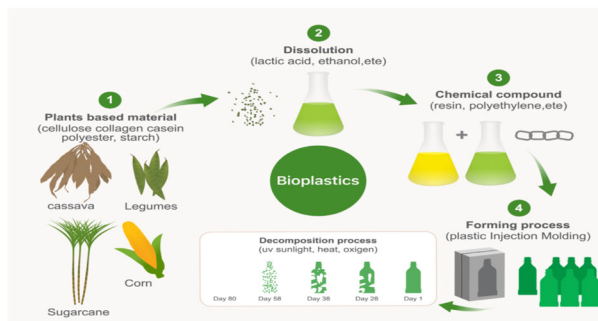
Integration with **Big Data** and **AI** for data mining.

Need for a **harmonized data ecosystem** for exposome research in India.

Way Forward

- **Adopt Exposomics in Public Health Policy:** Integrate exposome frameworks into national health surveillance and disease prevention strategies.
- **Invest in Environmental Health Infrastructure:** Build capacities for **data collection**, **wearable sensor tech**, **biomonitoring**, and **AI-driven analytics**.
- **Improve Data Ecosystems:** Create **interoperable data repositories** to support **longitudinal and multidimensional exposure analysis**.
- **Mainstream Environmental Risk in Public Health:** Link environmental exposures to chronic diseases through **evidence-based models** for **precision medicine**.
- **Collaborative Research and Capacity Building:** Encourage **multi-sectoral research**, training institutions, and **global collaboration** to lead in exposomics.

Bioplastics



Mains Practice Question

Q. Exposomics is emerging as a transformative approach to understanding the relationship between environmental exposures and public health outcomes. Critically evaluate its potential in the Indian context, especially in addressing the growing burden of non-communicable diseases and climate-induced health challenges. (15 marks, 250 words)

Aiming for an era of 'biohappiness' in India

Syllabus :

- GS Paper 1 – Indian Society
- GS Paper 2 – Governance & Social Justice
- GS Paper 3 – Environment, Agriculture & Biodiversity

Aiming for an era of 'biohappiness' in India

Recently, on a trip to Arunachal Pradesh, we were amazed by the diversity of greens in the diet – all freshly plucked from the forest and fields. Similarly, across rural and tribal areas of our country, one can find many varieties of millets, beans, legumes, tubers, wild fruits and green leafy vegetables, which the urban Indian is hardly aware of. The Nyishi and Apatani tribal communities in the State are knowledgeable about the nutritional and medicinal properties of many of these local plants.

A senior government official however warned of the rapid rate at which agrobiodiversity was disappearing in northeast India, mirroring the global rise in the rate of species extinction. Traditional knowledge about the medicinal and nutritional properties of these foods, as well as the culinary practices of tribal communities are probably going extinct at the same pace.

India's Biodiversity
India covers about 2% of global land area, but harbours nearly 8% of global biodiversity. It is ranked as one of 17 'megadiverse' countries of the world, contains sections of four of the 36 global biodiversity 'hotspots', and is one of just eight centres of global food-crop diversity. Natural services from India's diverse forests are valued at over USD 100 trillion a year, and local ecosystem services sustain livelihoods of a vast majority of the rural population.

However, continuous decline in our natural assets reduces India's GDP and hinders sustainable development. Yet, biodiversity and its potential to increase human well-being remain largely unexplored.

Global food systems are dominated by three crops – rice, wheat, and maize – which provide over 50% of the world's plant-based calories. This concentration and loss of biodiversity comes at a heavy price, causing nutritional imbalances, and vulnerability to climate shocks.



Dr. Soumya Swaminathan
is Chairperson of the M.S. Swaminathan Research Foundation



Dr. E.D. Israel
is Director, Biodiversity, M.S. Swaminathan Research Foundation

Sustainable use of natural resources – which includes bringing forgotten foods back to the table – will lead to better well-being

Non-communicable diseases such as diabetes and obesity are rising globally, and despite technological advances in agriculture that have enabled unprecedented gains in productivity, the benefits have not been equitably distributed, as the resilience of our food systems comes under threat.

For long we have ignored locally grown crops such as small millets, buckwheat, amaranth, jackfruit, yams and tubers, and indigenous legumes that remain classified as Neglected and Underutilized Species (NUS) in favour of popular commercial crops. The NUS, also known as orphan crops, are now being referred to as opportunity crops because they are nutritionally dense, climate-resilient, and adapted to local environments.

Crops and communities
Orphan (or Opportunity) crops have always been embedded in local culinary traditions, often linked with cultural identity and ecological knowledge. The community of Kollu hills (Eastern Ghats of Tamil Nadu) preferred growing locally adapted millets. Over three decades, farmers have moved to cultivating cash crops such as cassava, coffee, and pepper, resulting in a decline of agrobiodiversity. The M.S. Swaminathan Research Foundation (MSRF) has been working with agricultural communities here for over 20 years, to prevent the erosion of millet crop diversity in the region through participatory research and empowering farmers' groups. These interventions have enabled a community of farmers, especially women, to document traditional knowledge and best practices, while improving the vitality of the soil, diversifying crop production, improving local processing and value addition, leading to increasing income.

India's action plan under the UN-declared International Year of Millets and Shree Anna Yojana was focused on strategies to enhance

production and productivity, consumption, export, strengthening value chains, branding, creating awareness for health benefits and more. Many States have their own Millet Missions. In the Koraput district of Odisha, we have worked closely with the Odisha Millet Mission in supporting community-led millet revival from seed to consumption. While the focus nationally has been on ragi, jowar and bajra, the next step should be to expand the State missions to cover a variety of minor millets and to include them in the Public Distribution System.

More than five decades ago, Professor M.S. Swaminathan envisioned an Evergreen Revolution – that is rooted not in chemical intensification but in restoring ecological balance and nutrition security. The future of food is diverse and nutritious. To bring these forgotten foods back to the table is also to put our cultural identity and ecological knowledge at the forefront of the climate crisis – for people, planet, and its posterity.

An interdisciplinary science
Today, a new biodiversity science is emerging across the globe, which India can leverage, given its human resources and scientific infrastructure. Furthermore, this interdisciplinary science will help us meet our most pressing challenges in sustainable use of India's unique biodiversity, for agriculture and food production, health and nutrition, climate change and disaster risk management, bio-economy, and providing a variety of jobs to meet the needs of 1.4 billion people.

India could become a global leader in conservation and sustainable use of natural resources leading to better health and human well-being. Could we aim for an era of 'Biohappiness', as preciously envisioned by M.S. Swaminathan?

Key points from India's Biodiversity Richness

India's Biodiversity Richness

- Covers **2.4%** of global land but hosts 8% of global biodiversity.
- One of **17 megadiverse countries**.
- Home to sections of **4 global biodiversity hotspots**.
- Among the **8 global centers of foodcrop diversity**.
- Ecosystem services from forests valued at **₹130 trillion/year. article**

Threats to Agrobiodiversity

- Traditional foods like greens, legumes, and tubers in tribal diets are vanishing.
- Local ecological knowledge is being lost.
- Dominance of **rice, wheat, maize** in global food systems (50% of plant-based calories) has increased **nutritional imbalance and climate vulnerability**.

Opportunity in Neglected and Underutilized Species (NUS)

- Crops like **millets, jackfruit, yams, amaranth** are climate-resilient and nutrient-rich
- Termed as **opportunity crops** due to their potential in restoring **nutrition and food system resilience**.

Case Studies and Interventions

- **Kolli Hills (Tamil Nadu):** MSSRF revived millet cultivation through participatory approaches, enhancing **women's role, soil health, and income**.
- **Koraput (Odisha):** Collaboration with **Odisha Millet Mission** supported revival of millets from **seed to consumption**.
- National focus has largely been on **ragi, bajra, jowar**, but there's a call to widen this to include **minor millets** in **PDS**.







Vision of Evergreen Revolution

- Proposed by **M.S. Swaminathan**: a sustainable alternative to the Green Revolution.
- Based on **ecological balance, local food diversity, and nutrition security**.

Emerging Science and Global Potential

- An **interdisciplinary biodiversity science** is rising.
- Opportunity for India to become a **global leader in biodiversity-based solutions** for:
 - ♦ Agriculture & food systems
 - ♦ Health & nutrition
 - ♦ Climate resilience & disaster management
 - ♦ Jobs & sustainable livelihoods

Way Forward

	 Forgotten Crops	 Tribal Communities and Women	 MSSRF and Odisha Millet Mission	 Interdisciplinary Biodiversity Science
Goal	Mainstream into food systems	Preserve indigenous knowledge	Support biodiversity revival	Launch biodiversity-focused policies
Focus	Expand beyond mainstream millets	Involve in documenting practices	Scale-up successful models	Invest in research and development

Empowering women in green business

GS Paper 2: Governance & Social Justice

GS Paper 3: Economic Development & Environment

Empowering women in green business

Women-led green businesses are key to unlocking India's sustainable future



Gunjan Jhunjhunwala
Programme Lead at the CEEW.
Views are personal

Union Minister Piyush Goyal's recent call for greater innovation among Indian start-ups highlights an important challenge – and opportunity – that often gets overlooked: the need to support green innovation and increase the number of women-led green businesses in a world with an increasingly erratic climate.

Green enterprises are rapidly becoming an economic force. A study by the Council on Energy, Environment and Water (CEEW) shows that Odisha's green economy alone has a market potential of \$23 billion. Imagine scaling that across India, not only in renewable energy but also in sectors such as circular economy, bio-packaging, engineered bamboo, e-waste recycling, and battery manufacturing. Yet, women currently lead just 18% of all start-ups in 2024, limiting the pace and scale at which India can realise this green potential. On this Environment Day, it is critical to recognise that empowering more women entrepreneurs in the green economy is not only a matter of equity but also essential for building a sustainable and prosperous India by 2047.

What needs to be done
First, finance needs to be unbiased. All start-ups need to solve the wicked problem of raising funds, but it is a tad bit tougher when the green technology is new and you are a woman. For Rashmi Gupta, the founder of Vision Mechatronics, which operates in lithium-ion batteries,

finance had been a bottleneck since 2015. "Banks would ask who is the man behind the scenes. But now I see more women in climate tech," she said. While the situation has improved, financiers still perceive higher risks when investing in women. If a woman-owned business has a male co-founder, her ability to access credit significantly improves. This, despite global evidence that women make better borrowers.

A 2014 Ministry of Statistics and Programme Implementation report revealed that 79% of women entrepreneurs in India were self-financing, with only 1.1% borrowing from financial institutions. The government recognises this gap. The 2025



Budget announcement of term loans of up to ₹2 crore to first-time SC and ST women entrepreneurs sets a good precedent in its willingness to offer credit upwards of a crore. More schemes that offer credit or term loans upwards of ₹1 crore are needed.

Mahi Singh, the Jaipur-based co-founder of Cancerie that converts waste into advanced nano-material for battery efficiency, revealed that there is a need to demystify and simplify access to these schemes for women to consider the government as a lender. Enabling end-to-end online access is one way. For private lending, boards of banks and investment firms can earmark a percentage of their portfolio towards green innovations and must include reporting on the percentage of credit offered to women-run green businesses in their annual reviews.

Second, women in green businesses need better-quality mentorship tailored to their specific challenges. "Who do we look at as role models," asks Vanita Prasad of Revy Environmental Solutions. Women entrepreneurs highlighted initiatives such as the BRICS bootcamp, the Women Entrepreneurship Platform initiated by the NITI Aayog as useful mentorship platforms.

We also need more collaborations that offer management training, mentoring, networking, and access to capital for greater women's contribution to a green economy.

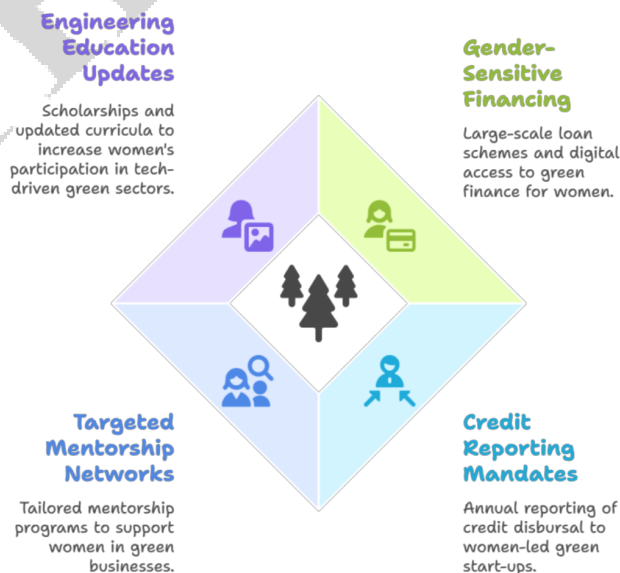
Third, tip the poor ratio of women in engineering, currently at 19.2%, by updating the engineering curricula with significant automation advances and offering scholarships. Automation means more women can now train in erstwhile literal heavy-lifting engineering roles. Renewable energy, circular economy, and biotechnology, in particular, require technology-driven solutions, and more women engineers are the foundational step. "Women of Mettle" by Tata Steel offers scholarships to women engineers in the manufacturing sector. Large manufacturing corporations and dedicated funds are required to provide such scholarships.

To unlock India's green growth potential, we must address the barriers that women entrepreneurs face in the green economy. By fostering targeted mentorship, improving access to finance, and building trust in women-led businesses, we can ensure that more women take the lead in shaping a sustainable future. Empowering women is essential for achieving India's vision of a sustainable, developed nation by 2047.

Key points from article

- **Green Business Potential in India**
 - ◆ Odisha alone has a **green market potential of \$23 billion**.
 - ◆ Sectors include: **renewables, circular economy, ewaste recycling, bio-packaging, engineered bamboo**, etc.
 - ◆ Women-led start-ups form only **18%** of total in 2024.
- **Challenges Faced by Women Entrepreneurs**
 - I. **Gender bias in finance:** Women face skepticism from banks and VCs; male co-founders often increase fund access.
 - II. **Self-financing prevalent:** As per a 2014 MoSPI report, **79%** of women entrepreneurs are **selffinanced**, only 1.1% took institutional credit.
- **Government & Institutional Efforts**
 - ◆ 2025 Budget: Term loans up to **₹2 crore for first-time SC/ST women entrepreneurs**.
 - ◆ **Need for more loan schemes \geq ₹1 crore and end-to-end online access** to simplify processes.
 - ◆ Private banks urged to **allocate portfolio quotas and report % of lending to women-led green firms**.
- **Women in Engineering**
 - ◆ Women make up only 19.2% of engineering grads.
 - ◆ Need for **automation-based curricula, scholarships** (like Tata Steel's *Women of Mettle*) to boost participation in heavy-industry sectors like renewable energy and biotechnology

Empowering Women in Green Finance



The seeds of sustainability for India's textile leadership

Syllabus :

GS Paper 2: Governance & Social Justice

GS Paper 3: Economic Development & Environment

The seeds of sustainability for India's textile leadership

Even as one of the world's largest manufacturing hubs, the Indian textile industry faces challenges in sustaining its global presence due to geopolitical tensions, fragmented supply chains, and product price volatility. Climate change or evolving consumer demands are not the only causes, but also the fundamental values that influence business decisions.

In this evolving landscape, achieving a market competitive edge depends on long-term presence, and businesses should explore beyond financial goals, as adaptability, purpose-led innovation, and resilience are also essential. For India to establish its global trade authority, the cultivation, sourcing, and manufacturing practices must be re-examined with a sustainable lens.

Concepts such as regenerative farming, traceability solutions, and product circularity are becoming the operational standards and core manufacturing actions in the industry.

As the sixth-largest exporter of textiles globally, adopting these practices would help the textile industry in strengthening its leadership. We are presented with a growth opportunity to emerge as an important player in the China Plus One strategy, reducing dependence on China and unlocking India's trade potential.

Regenerative farming
In India, regenerative (regen) farming is a viable model amidst concerns of raw material sourcing, climate change, land degradation, and soil erosion. Regen farming practices are already under way in India, with the Ministry of Agriculture and Farmers Welfare considering approximately over one million hectares of farmland for further pilot projects in the coming years. Farmers are equipped with digital



Dipali Goenka
CEO and MD, Welspun Living

Strategic decisions made today will help India's global leadership for a sustainable, future-proof, and resilient textile economy

resource-based training on regen farming practices.

Real-time data sharing is enabled for growth tracking and transparency. This ecosystem leads to a business model where farmers remain connected with certification bodies, manufacturers, and global market brands.

In Aurangabad, Maharashtra, over 6,000 farmers have joined the Regenerative Cotton Program, which has already shown positive impacts – higher yields, improved climate resilience, reduced reliance on chemical fertilizers, and more cost-effective inputs – leading to better risk management and stable incomes.

Regen farming as a solution helps tackle multiple business concerns at once: rural engagement, improved yields, multi-stakeholder collaborations, and even breaking gender stereotypes in farming. It can also enhance traceability, sustainability compliance, and product quality assurance across

the supply chain. The regen farming model is potentially a strong solution to drive India's leadership in the global textile market.

Traceability solutions

Traceable supply chains have a strong potential to ensure product credibility across all stages – sourcing, production, and distribution. Over 37% consumers in the 2023 Consumer Circularity Survey identified sustainability and traceability as important criteria in their purchases. Robust AI and tech-driven traceability solutions are the next big

strategies that the Indian textile sector can adopt. Traceability has already transformed from the logistical tracking of a product to delivering a narrative of authenticity and brand accountability.

India's branding initiatives, such as Kasturi Cotton, strengthen the case of traceability, transparency, and quality benchmarking globally. Although currently in the final stages, the India-U.K. Free Trade Agreement (FTA) could amplify such advantages, since the U.K. has one of the world's most environmentally conscious consumer bases.

The EU also emphasises transparency and traceability in the textile industry through international frameworks and DPPs, to protect consumer and environmental concerns.

With the concessions for textiles addressed by the India-U.K. FTA, traceability solutions can help industry players leverage sustainability stories and thereby expand their market presence.

Product circularity

India generates 8.5% of the world's annual textile waste. To retain a competitive edge, the Indian textile industry's vision is to

embrace product circularity and sustainability practices. Product designs must evolve from recyclability to also having a longer lifecycle. This means establishing a system at every stage of production – from fibre creation to product development, plastic-free packaging, and post-use consumer disposal – with circularity principles embedded throughout.

Factory waste can be reengineered for newer designs and eventually returned to the soil after a longer product lifecycle.

As endorsed by REIA's initiatives, a well-functioning circular economy can lead to product innovation, generating more jobs, and an economic competitive edge. India can therefore reduce its reliance on unused raw materials and build a better, self-reliant, and globally relevant system for generations – a vision that the Gof's Viksit Bharat initiative also advocates.

The textile industry must commit to making in India for the world, but through circular, sustainable, and responsible means.

Growing towards

The textile industry is projected to grow to \$350 billion by 2030 and could add 35 million new jobs if we align with climate goals and tech-driven innovations. The industry can redefine its global trade leadership vision, with not just manufacturing in volumes, but also with its core business values. We must step ahead of tokenistic green messaging and adapt business models that prioritise regenerative farming practices, traceability solutions, and product circularity.

Strategic decisions made today will help India's global leadership for a sustainable, future-proof, and resilient textile economy. The fabric of the economy's future is dependent on what we envision today and the purposeful designs for the environment that we weave responsibly.



The textile industry is projected to grow to \$350 billion by 2030 and could add 35 million new jobs if we align with climate goals. REUTERS

Key Points from the article

India's Global Position in Textiles

India is the **6th-largest textile exporter globally**.

Faces challenges due to **geopolitics, fragmented supply chains, price volatility, and the need for values-driven innovation**.

Sector projected to grow to **\$350 billion by 2030** and add **35 million jobs** if aligned with sustainable strategies.

Key Pillars for Transformation

Regenerative Farming (Regen Farming) Tackles raw material sourcing, climate risks, soil erosion, and land degradation.

Pilots in India: Over **1 million hectares** under consideration; **6,000+ farmers** in Maharashtra in Regenerative Cotton Program.

Benefits:

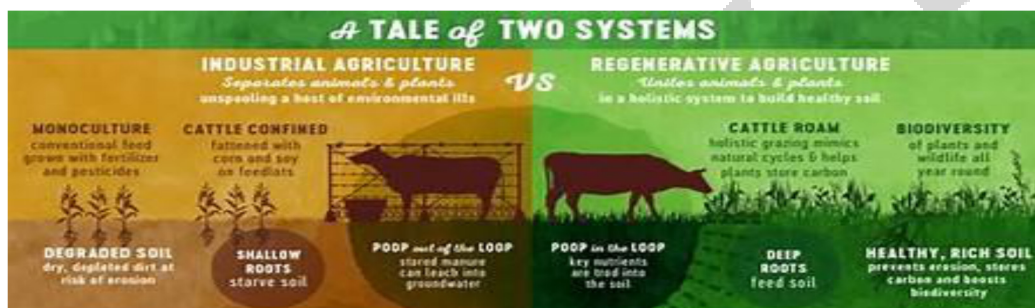
Higher yields, climate resilience, and reduced fertilizer use.

Promotes **rural engagement**, **gender inclusion**, and **supply chain traceability**.

Connects farmers with **certification bodies** and **global brands**.

Helps position India as a **global textile leader**.

6 Core Principles of REGENERATIVE AGRICULTURE



● Traceability Solutions

- ◆ Enhances **product credibility** and **brand trust**.
- ◆ Growing consumer demand: **37% consumers (2023 survey)** prioritize sustainability and traceability.
- ◆ Use of **AI and tech** for real-time supply chain transparency.
- ◆ Boosted by initiatives like **Kasturi Cotton** and potential impact of the **India-U.K. FTA** and EU's **Digital Product Passports (DPPs)**.

● Product Circularity

- ◆ India produces **8.5% of global textile waste**.
- ◆ Must shift from **recyclability** to **full lifecycle design**.
- ◆ From fiber to packaging to post-consumer disposal.
- ◆ Factory waste should be **reengineered** and **soil-returnable**.
- ◆ Endorsed by REIAI; aligned with **Viksit Bharat** initiative.
- ◆ Circular economy enables **product innovation**, **job creation**, and **resource efficiency**.

Has the environmental crises in India exacerbated?

GS Paper 3 – Environment and Ecology

Has the environmental crisis in India exacerbated?

What are the major factors which contribute to the current environmental crisis?

Tikender Singh Panwar

The story so far:

As we observe June 5 as World Environment Day, one takes stock of how the previous decade has exacerbated/mitigated existing environmental crises.

What are main environmental crises?

The world is grappling with three deeply intertwined planetary crises: carbon emissions, biodiversity loss, and pollution. Over the last 10 years, these crises have deepened, despite growing awareness and international efforts.

Between 2015 and 2024, global CO₂ emissions rose from around 34.1 billion metric tonnes to 37.4 billion metric tonnes, a nearly 10% increase. In the same period, India's emissions surged from 2.33 billion to 3.12 billion metric tonnes, persistent dependence on coal

and oil. On the biodiversity front, mass extinctions and ecological disruptions are becoming the norm. India, with its mega-diverse ecosystems, faces growing threats from deforestation, wetland degradation, and monoculture agriculture. Meanwhile, pollution, particularly air pollution, has remained stubbornly high. India consistently ranks among the world's most polluted countries, with Delhi topping global lists.

What are the root causes?

There are myriad causative factors. First is fossil fuel dependency. Most global carbon emissions are driven by coal, oil, and gas consumption in power generation, transportation, and heavy industry. In India, coal still accounts for nearly 70% of electricity generation. Second, we have deforestation and land-use change. In India, forest clearances for roads, mining, and dams have increased, especially in

biodiversity-rich regions like the Western Ghats and the northeast. Third, agricultural intensification. High-input monocultures, especially driven by agribusinesses, destroy habitats and pollute water bodies with nitrates, pesticides, and plastics. Waste mismanagement and unchecked urbanisation is also a major factor causing environmental degradation. Unregulated landfills, untreated sewage, and industrial effluents have polluted rivers like the Ganga and Yamuna. India generates 62 million tonnes of waste annually, of which barely 20% is scientifically processed. And finally, overconsumption and industrialisation. The Global North's high consumption and global supply chains externalise pollution and ecological damage to the Global South.

How is India positioned?

As a developing economy, India has a smaller per capita carbon footprint (~1.9

its aggregate emissions are rising due to rapid industrialisation and urbanisation. The poor bear the brunt of pollution and climate shocks – whether in Delhi's smog-choked slums or drought-stricken villages in Maharashtra. Yet India is also a victim of the environmental damage caused by global forces. Climate change, largely driven by the historical emissions of richer nations, has intensified India's monsoons, floods, and heatwaves, while biodiversity loss has weakened India's food systems and health infrastructure.

What needs to be done?

A meaningful response must include accountability from nations of the Global North. Wealthy nations must drastically cut emissions, provide climate finance, and stop outsourcing dirty industries. Large polluting corporations must also be held accountable through strict laws and carbon taxation. Moreover, the future of development must be based on ecological concerns. For example, corporations that do not adhere to the 'green policy' should not be allowed to trade in the market. Creating such protocols will pave way for systemic changes. Sustainable development should be encouraged with a shift toward low-carbon livelihoods, ecological agriculture, and community-led conservation.

Tikender Singh Panwar is former deputy mayor of Shimla, and member of the Kerala Urban Commission.

THE GIST

▼ The world is grappling with three deeply intertwined planetary crises: carbon emissions, biodiversity loss, and pollution.

▼ As a developing economy, India has a smaller per capita carbon footprint (~1.9 tonnes/year vs. the U.S.'s 14.7 tonnes), yet its aggregate emissions are rising due to rapid industrialisation and urbanisation.

▼ A meaningful response must include accountability from nations of the Global North.

India's Dual Role – Victim and Contributor

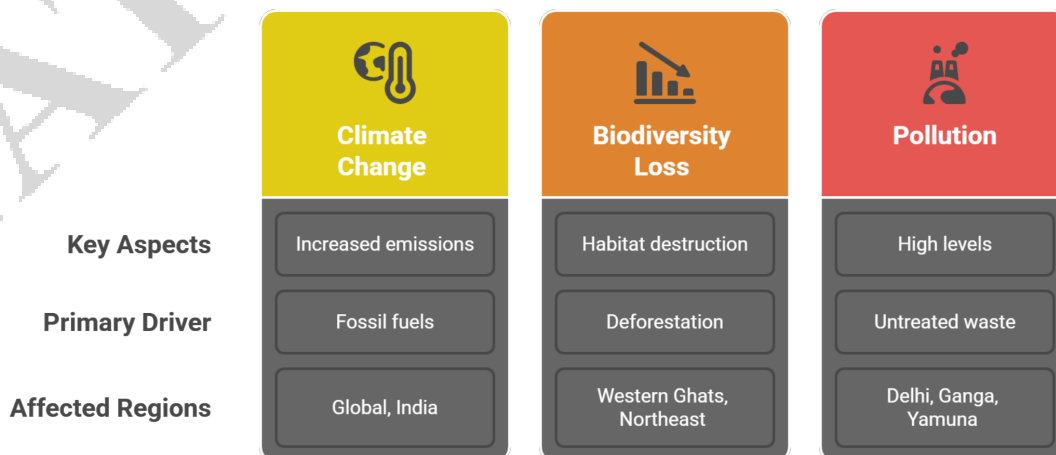
- **Per Capita Emissions Low (~1.9 tonnes) but aggregate emissions rising.**

- **Poor communities bear the brunt of:**

Heatwaves, droughts, floods intensified by climate change. Smog, polluted rivers, and toxic urban conditions.

- **India also suffers from externalised environmental damage caused by high emissions from Global North countries.**

Environmental Challenges in India



Way Forward

- **Accountability from the Global North**
Cut emissions drastically.
Provide **climate finance**.
Ban outsourcing of polluting industries.
- **Corporate Responsibility**
Enforce **carbon taxation** and **strict green compliance**.
Ban non-compliant corporations from trading.
- **Systemic Green Transitions**
Promote **low-carbon livelihoods**.
Encourage **ecological agriculture** and **community-led conservation**.
Redesign development models around **ecological justice**.

Mains Practice Question

Q. India is both a contributor to and a victim of the global environmental crisis. Critically examine the major drivers of environmental degradation in India and suggest policy-level reforms to mitigate them.
(15 marks, 250 words)