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EARTH ROOT

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About E-magazine

"Earth Root" is an open access e-magazine in the discipline of Environmental sciences published by Earth Root Foundation. The aim of the e-magazine is to provide information and upgradation of knowledge about environmental issues on wider scale and to share ideas and resources to the readers. Using essential knowledge people can lead a healthy life, which is more sustainable and can connect with ongoing efforts for stopping catastrophically the climate change. E-magazine caters to all related environmental aspects ranging from big issues like climate change, renewable energy and pollutants in the atmosphere to the health of human and living beings on Earth. We also take topics of water resources and efforts and measurement to provide optimum use of it; including large scale atmospheric circulation linked with oceans and ecology.

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MICROMANAGEMENT FOR CLEANER SKIES IN DELHI NCR

- Dr. Palak Balyan
Research Lead, Climate Trends

Air pollution in Delhi NCR has become a recurring public health emergency that affects millions of people every winter, but it is also a challenge that can be managed more effectively through a system of micromanagement. Large policies and mega plans often receive the spotlight, yet it is the smaller, continuous, neighbourhood-level actions that create lasting change. Micromanagement does not mean minor effort; it means breaking down a large and complex pollution problem into structured, actionable steps shared between the government and the public. When governments enforce tighter monitoring and citizens change their everyday habits, the combined effect becomes powerful enough to shift the air quality trajectory.

One of the most effective ways the government can apply micromanagement is by focusing on hyperlocal monitoring. Delhi NCR already has several air-quality stations, but the region needs hundreds of micro-sensors placed in markets, industrial pockets, school zones and residential clusters. These small devices do not require massive infrastructure and can detect pollution spikes within minutes, allowing authorities to track pollution sources at the lane level rather than at the district scale. If a particular neighborhood sees a sudden rise in PM2.5, officials can immediately investigate whether it is due to illegal burning, a malfunctioning generator, or construction activity. This approach makes clean-air enforcement far more responsive and precise.

Construction dust is one of the biggest contributors to Delhi's winter pollution. Instead of waiting for complaints or seasonal bans, local enforcement teams can carry out daily micromanaged inspections of construction sites within defined grids. Every site can be required to upload live photographs of dust-control measures to a central portal, along with timestamps to ensure compliance throughout the day. Penalties should not be applied only as large fines at the end of the month, but also as small, frequent warnings and spot charges that create continuous accountability. When micromanagement is practiced consistently, even medium and small construction contractors begin to follow norms because they know that

violations are visible instantly. Industries across NCR can also benefit from this method. While factories are often blamed, many operate with limited awareness or outdated practices. A micro-level approach can involve cluster-wise audits where small teams work directly with industrial units to identify emission leaks, fix chimneys, improve fuel efficiency and switch to cleaner technology. Instead of a one-size-fits-all regulation, each cluster can have a personalized action plan based on its industrial profile. Regular communication between pollution control officers and local manufacturers helps create trust and ensures that environmental compliance does not feel like policing but like guided improvement.

The transport sector is well suited to micromanagement through behavioural nudges and local incentives. Instead of disruptive car bans, authorities can promote measures such as designated pickup points to cut idling, staggered timings in high-pollution zones, neighbourhood carpooling, and block-wise adjustment of public transport routes. Electric rickshaws and bikes can be supported through small charging stations in community parking areas. Traffic police can enforce anti-idling rules at intersections, handing out small penalties that cumulatively create discipline and reduce vehicular emissions significantly. However, government actions alone are not enough. Public participation is the backbone of any micromanagement approach, and residents of Delhi NCR hold immense power to reduce pollution through everyday choices. One of the simplest yet most impactful steps is proper waste management. A large portion of seasonal smog comes from small-scale household burning of leaves, packaging materials, and wet waste. Community awareness drives, door-to-door messaging, and local composting pits can eliminate the need for burning. RWAs can appoint volunteer monitors who discourage burning within their neighbourhoods, and households can be encouraged to segregate waste properly so that municipal systems function more efficiently. Greenery at micro scales can have a powerful impact.

Beyond large city parks, colonies, schools, and institutions can plant hardy native species such as neem, amla, and jamun to trap dust and improve local microclimates. Rooftop and vertical gardening, when adopted widely, can collectively reduce temperatures and enhance air filtration.

Micromanaging greenery enables residents to contribute directly to urban resilience. Public behaviour around mobility must also change. Walking short distances instead of using two-wheelers, choosing shared rides, avoiding unnecessary vehicle use during peak pollution periods, and maintaining engines regularly are micromanagement practices that require no new policy. Schools can support this shift by teaching students micro-actions such as reporting pollution sources, using low-cost air-quality sensors, and joining traffic-reduction efforts. When children influence household habits, change becomes broader and more durable.

Effective communication is essential. Instead of generic advisories, governments can issue micro-level air-quality alerts at ward or neighbourhood scales. Residents in specific areas of Rohini or Noida could be warned of locally driven pollution and encouraged to avoid outdoor burning or report sources. Such targeted messaging promotes responsibility, while apps enabling citizens to submit geotagged evidence can help authorities respond swiftly.

Micromanagement complements rather than replaces major policies. While large-scale measures like electrifying bus fleets, building expressways, and regulating crop burning remain essential, the real gap lies in everyday actions. Since pollution comes from many small sources, it requires many small solutions.

With shared commitment from government and citizens, micromanagement can make cleaner air in Delhi NCR achievable. The region has the capacity to act; what it needs is a cultural shift where people see themselves as contributors, not victims. Clean air is a collective behavioural change built step by step.

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VANISHING GUARDIANS OF THE HIMALAYA

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Glaciers in the Himalayan region have long been regarded as timeless giants, silent and unshakable. They feed some of the world's major rivers, sustain millions of people downstream and maintain delicate ecological balances across mountain landscapes. Yet, these icy reserves are now disappearing at a pace that has deeply alarmed scientists, policymakers and communities who depend on them. The Himalaya, often called the Third Pole for its immense ice reserves, is warming faster than the global average. This rapid rise in temperature, combined with pollution and intensified human activity, is placing extraordinary stress on glaciers that have taken centuries or even millennia to form.

One of the most visible signs of climate change in the Himalaya is the accelerated retreat of glaciers. Satellite monitoring by scientific institutions has revealed dramatic changes in glacier length, volume and mass over the last few decades. Even smaller glaciers, once considered relatively stable, are shrinking noticeably every year. As global temperatures climb, snowfall patterns shift and summer heatwaves become more intense, the accumulation of ice declines while melting increases. This leads to a dangerous imbalance that glaciers cannot withstand. Glaciologists warn that if warming continues at the current rate, many Himalayan glaciers could lose a significant portion of their mass well before the end of the century. Melting glaciers do not simply vanish quietly. They leave behind vast pools of water known as glacial lakes, often held back by fragile natural dams made of loose rocks and ice. As meltwater continues to collect, the pressure on these dams intensifies, raising the risk of glacial lake outburst floods. Such events can release millions of cubic meters of water in a matter of minutes, destroying roads, villages, farmland and hydropower infrastructure. Recent incidents in Nepal, Bhutan and northern India have shown the magnitude of these disasters. Communities living in high-altitude valleys now face growing uncertainty as new glacial lakes appear and existing ones expand at alarming rates. Pollution, an often overlooked but serious threat, is also accelerating the decline of Himalayan glaciers. Soot and black carbon particles released from vehicles, coal combustion, biomass burning and industrial emissions travel long distances through the

atmosphere before settling on glacier surfaces. Once these dark particles accumulate on ice, they reduce its reflectivity. Instead of bouncing sunlight back into the atmosphere, the soot-covered glacier absorbs more heat, causing the ice to melt faster. Researchers have found that black carbon can significantly contribute to glacier retreat, particularly in regions close to densely populated plains where anthropogenic emissions are high. This means that urban pollution in northern India or the Indo-Gangetic plains has a direct and destructive impact on glaciers thousands of meters above sea level. Human activity in the Himalaya itself is also amplifying the stress on these fragile ecosystems. Expanding tourism, infrastructure development and hydropower projects are increasing pressure on mountain environments. Roads cut into steep slopes destabilize the terrain, while construction activities bring dust, debris and vibrations that disrupt natural processes. Unregulated trekking routes and high-altitude settlements generate waste that often ends up in glacial streams. Hydropower projects, though essential for clean energy, sometimes alter river flows and involve tunneling or blasting that affects the stability of nearby slopes and glaciers. These cumulative impacts make the region more vulnerable to landslides, erosion and hydrological changes.

The consequences of melting Himalayan glaciers extend far beyond the mountains. These glaciers act as water towers for Asia, feeding major rivers such as the Ganga, Yamuna, Brahmaputra and Indus. They ensure steady water supply during dry months by releasing meltwater at a controlled pace. As glaciers shrink, this natural regulation weakens. In the short term, increased melting may lead to higher river flows, raising the risk of floods. In the long term, however, reduced ice reserves could drastically diminish water availability, affecting agriculture, drinking water supplies and hydropower generation for millions of people. Countries downstream, already facing seasonal water stress, could experience even greater scarcity, potentially triggering social and economic tensions. Ecosystems tied to glacier-fed rivers are also under threat. Cold-water species, including fish and alpine vegetation, are sensitive to even small changes in water temperature and volume. As river systems warm and flow patterns shift, these species struggle to survive. The loss of biodiversity in mountain regions not only disrupts ecological balance but also affects the livelihoods of indigenous communities who depend on these resources for food, medicine and cultural practices.

Despite these challenges, there is still hope. Scientific understanding of Himalayan glacier dynamics has improved significantly in recent years, aided by remote sensing, field surveys, climate modelling and international collaboration. Many Himalayan nations are establishing early warning systems for glacial lake outburst floods, upgrading hydrological monitoring networks and investing in climate-resilient infrastructure. Local communities are increasingly engaged in conservation efforts, from reducing waste in high-altitude trekking areas to adopting cleaner cooking technologies that reduce black carbon emissions. Mitigating the threats to Himalayan glaciers requires a combination of global climate action and regional cooperation. Reducing greenhouse gas emissions remains the most critical step to slowing glacier melt. At the regional level, controlling air pollution, particularly black carbon, can offer immediate benefits by decreasing heat absorption on glacier surfaces. Sustainable tourism policies, responsible infrastructure development and strengthened environmental regulations are essential for protecting vulnerable mountain landscapes. Equally important is involving local communities, whose traditional knowledge and close relationship with the mountains make them vital partners in conservation. The Himalayan glaciers are more than frozen landscapes; they are lifelines, cultural symbols and climate stabilizers. Their disappearance would reshape rivers, ecosystems and societies across South Asia. Protecting them is both an environmental and humanitarian necessity, as their rapid loss threatens the future of the region that depends on them.

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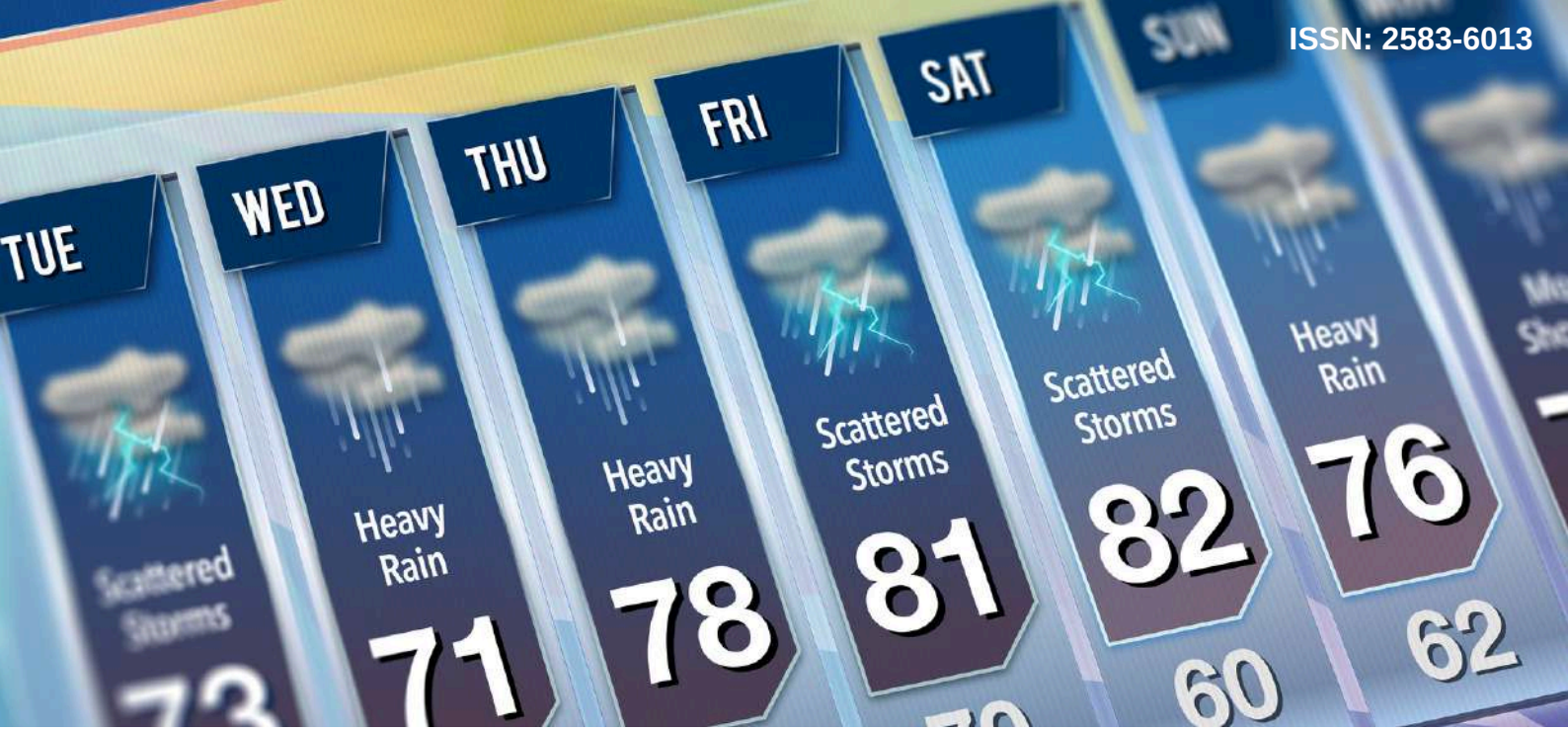

WHEN THE SKY TURNS FIERCE: HOW EXTREME WEATHER IS WARNING US ABOUT A CHANGING PLANET

- Pulkit Goel
Freelance Writer

Extreme weather is no longer a distant concern discussed only in climate conferences. It has become an everyday reality for millions around the world. Floods, storms and unprecedented rainfall events are reshaping landscapes, taking lives, and unsettling economies with a force we once associated only with rare natural disasters. In the last few years, but especially this year, the scale and intensity of these weather events have sent a clear message that the climate system is changing faster than our ability to adapt.

Countries across Southeast Asia, including Indonesia, Sri Lanka and Thailand, have faced devastating floods and storms that collectively claimed thousands of lives. These were not isolated disasters. They occurred within weeks of each other, powered by a combination of warmer oceans, shifting wind patterns and disrupted monsoon systems. Scientists studying these events emphasize that climate change is acting as a threat multiplier. That means it does not necessarily create new weather systems from scratch, but it strengthens existing ones, making storms wetter, floods faster, and recovery periods longer.

One of the most troubling aspects of recent floods is how unpredictable they have become. Traditional markers such as seasonal forecast patterns no longer hold the same reliability. In many regions, rainfall that is typically distributed over a month now arrives within a single day. Rivers swell with extraordinary speed, urban drainage systems collapse under pressure, and coastal regions face simultaneous threats from rain-induced flooding and rising sea levels. The combined effect leaves communities with little time to prepare and even less time to respond.

Behind this lies a fundamental physical process. A warmer atmosphere holds more moisture. Every degree of temperature rise increases the air's ability to retain water vapour, making rainfall events far more intense. At the same time, oceans are absorbing excess heat caused by greenhouse gas emissions. This warms the surface waters, which then feed storms and cyclones with more energy. The storms grow in size, last longer, and produce more rain than historical averages would suggest. When these energetic systems make landfall, they unleash destructive force that even disaster-prepared regions struggle to withstand.

But floods and storms are not just meteorological episodes. They are deeply human events that expose inequalities. Low-income communities living in informal settlements near rivers or coastal zones suffer the most. They lack strong housing, access to early warning systems, and safe evacuation spaces. Their livelihoods are often tied to fragile ecosystems such as fishing zones, mangrove belts or agricultural fields. After a disaster, they face the double burden of rebuilding their homes and reviving their incomes, often with little government support. The climate crisis is therefore not just an environmental story but a social one, revealing how vulnerabilities are unevenly distributed.

Another consequence of extreme weather is its impact on public health. Floodwaters become carriers of disease as sewage lines overflow and clean water sources become contaminated. Hospitals, already overwhelmed during disaster seasons, struggle to handle outbreaks of water-borne illnesses. At the same time, prolonged heatwaves that often precede storm seasons weaken the body's resilience, particularly for older adults, children and those with chronic illnesses. The combination of heat stress and flood-induced disease creates a cycle of health risks that many societies are not adequately prepared for.

Agriculture, too, faces significant disruptions. Fields that should receive steady monsoon rains instead experience prolonged dry spells followed by intense downpours. Crops fail due to both drought and waterlogging, reducing yields and threatening food security. Farmers, especially small landholders, find themselves caught in a climate double bind. They must navigate unpredictable seasons without the financial buffer to absorb losses. In some regions, repeated crop failures have triggered migration, with rural families moving to cities in search of work, further straining already growing urban populations.

Infrastructure systems, which form the backbone of modern life, have proven extremely vulnerable to climate extremes. Roads crack under heat and collapse under floods. Electricity grids fail during storms. Water supply networks get contaminated or damaged. Repairing these systems requires huge investments and time, but many countries experience disasters so frequently that rebuilding becomes a continuous cycle rather than an occasional necessity. Economists warn that climate-related disasters could significantly slow development in vulnerable regions, diverting funds away from education, healthcare and long-term planning.

Despite these alarming trends, the situation is not without hope. Early warning systems have become more accurate, giving communities precious hours or even days to prepare. Nature-based solutions such as restoring wetlands, expanding mangroves and creating urban green spaces have shown remarkable potential in reducing the impact of floods. These natural barriers absorb excess water, stabilize coastlines and provide habitats for wildlife. Countries that have invested in such solutions are beginning to see measurable benefits during storm seasons.

However, what is needed most urgently is a shift in how societies think about climate risk. Extreme weather must be treated as an expected part of life rather than an occasional anomaly. Urban planning needs to incorporate flood-resistant infrastructure. Building rules must account for stronger winds and heavier rains. Agricultural practices should move toward climate-resilient crops and water-efficient farming. Governments must allocate dedicated budgets for disaster preparedness instead of reacting after the damage is done. International cooperation is equally important. Climate change does not respect national boundaries, and neither should our strategies for resilience.

The recent surge in extreme floods and storms is a warning, but also an opportunity. It urges us to reconsider how we design our cities, how we use our land, how we generate energy and how we protect the poor. Climate change is not a distant future; it is unfolding right now in swollen rivers, broken dams, uprooted trees and disrupted lives. The question is whether we will act with urgency and imagination or continue responding only after disaster strikes.

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WHEN WATERS TURN GREEN A GROWING THREAT FROM ALGAE BLOOMS

- Prof. Deeksha Katyal
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Water bodies across the world are experiencing a silent but fast-spreading crisis. Lakes, rivers and coastal zones that once supported thriving ecosystems are increasingly turning murky shades of green, blue-green or even red. This transformation is driven by the rise of harmful algal blooms, a phenomenon that has intensified in recent years due to pollution, warming temperatures and changing rainfall patterns. Although algae are natural components of aquatic ecosystems, excessive blooms disrupt ecological balance, threaten human health and destabilize water-dependent economies. The growing scale, frequency and toxicity of these events have made them one of the most urgent environmental challenges of our time.

At the heart of the problem lies nutrient pollution, particularly the influx of nitrogen and phosphorus into water bodies. These nutrients, commonly found in agricultural runoff, untreated sewage, detergents and industrial waste, act as fertilizers for algae. When they enter lakes and rivers in large quantities, they trigger explosive growth of algae populations. Many countries, including India, face this issue because of rapid urbanisation, intensive farming, insufficient wastewater treatment and the dumping of solid and liquid waste into water sources. In places where monsoon rains flush large amounts of nutrients from fields and cities into waterways, the problem becomes worse and blooms peak soon after heavy rainfall.

Climate change is amplifying the threat dramatically. Rising temperatures create warm, stagnant conditions that favour the growth of harmful algae, especially cyanobacteria, also known as blue-green algae. These microorganisms thrive in still, nutrient-rich waters and often produce toxins that can harm fish, livestock, wildlife and even humans. Heatwaves, increasingly common in South Asia, worsen the situation by increasing water temperature for extended periods. Unpredictable rainfall patterns also play a role. When rains fail, water levels decrease and pollutants become more concentrated. When extreme rainfall occurs, large quantities of

nutrients are washed into rivers and lakes in a short span of time. This weather volatility supports algae proliferation in ways that did not exist decades ago. The ecological consequences of algal blooms are severe. Thick mats of algae block sunlight from reaching underwater plants, disrupting photosynthesis and killing vegetation that fish and other organisms depend on. When algae die, they decompose and consume dissolved oxygen, creating dead zones where aquatic life cannot survive. Fish kills, sometimes involving thousands of fish washing up on shores, are increasingly reported worldwide. In coastal ecosystems, algal blooms can devastate coral reefs, smother seagrass beds and alter food chains. These disruptions ripple through entire ecosystems, reducing biodiversity and weakening the resilience of natural habitats.

Human communities also face significant risks. Certain species of algae release toxins known as cyanotoxins that are extremely harmful even in small quantities. These toxins can contaminate drinking water supplies, making water unsafe for consumption without advanced treatment. In India, several lakes that serve as drinking water sources for cities have experienced toxic blooms, forcing authorities to close water intakes or issue health advisories. Exposure to contaminated water can cause skin irritation, allergic reactions, respiratory issues and gastrointestinal illness. Pets and livestock are particularly vulnerable because they may drink directly from affected water bodies. Coastal algal blooms, such as red tides, can contaminate seafood and lead to paralytic or neurotoxic shellfish poisoning if consumed.

Beyond health risks, algae blooms carry significant economic impacts. Fisherfolk and aquaculture operators suffer losses when fish die or when water conditions become unsuitable for breeding. Tourism declines when lakes and beaches become foul-smelling, discoloured or unsafe for recreation. Waterfront businesses, restaurants and hotels feel the impact almost immediately. Municipalities spend large amounts on water treatment, mechanical removal of algae or restoration measures. These costs further strain developing regions with already limited water infrastructure. Algal blooms can be controlled by reducing nutrient pollution at its source through better sewage treatment, lower industrial discharge, bans on phosphate detergents, and sustainable farming practices. Measures such as precision fertilisation, buffer strips, and green urban infrastructure like wetlands can significantly cut nutrient runoff into water bodies.

Monitoring and early warning systems also play a vital role. Satellites, drones and advanced sensors are increasingly being used to detect bloom formation and measure water quality in real time. When authorities receive early alerts, they can implement temporary restrictions, aerate water bodies to improve oxygen levels or issue public warnings if necessary. In some places, introducing certain species of plants or filter-feeding animals helps control excess nutrients naturally, although these measures must be carefully managed to avoid unintended ecological effects.

Public awareness is a powerful tool in tackling algal blooms. When communities understand their causes and impacts, they are more likely to support pollution controls, join cleanup efforts, and change harmful behaviours. Simple household actions, along with education through schools and local programs, can significantly reduce nutrient pollution and help protect freshwater resources.

As algae blooms continue to rise in frequency and intensity, they signal a deeper environmental imbalance driven by pollution, climate stress and unsustainable practices. These green waters are not just seasonal inconveniences but warnings of long-term ecological decline. Protecting lakes, rivers and coastal ecosystems requires collective action from governments, industries, scientists and citizens. If we act decisively, it is possible to restore the natural clarity and vitality of our waters. If not, we risk allowing a preventable crisis to grow into an irreversible transformation of our planet's most precious resource.

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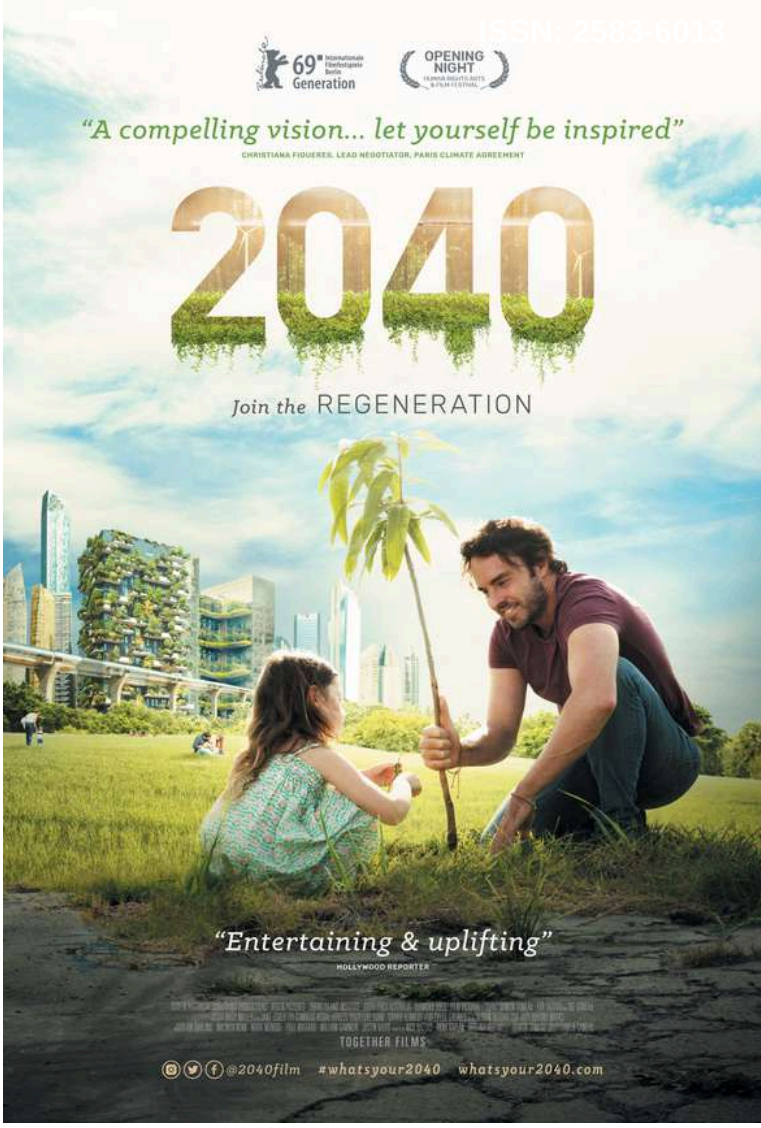
MOVIE
RECOMMENDATION

2040

2040 is a hopeful, solution-driven climate documentary that looks beyond the problem to imagine a future where climate change has been successfully tackled. Rooted in real science and existing innovations, the film explores practical pathways such as renewable energy, climate-friendly technologies, progressive policies, and global cooperation. By focusing on human ingenuity and collective action, 2040 reframes the climate crisis as an opportunity for positive transformation at both individual and global levels.



PLOT SYNOPSIS

2040 follows filmmaker Damon Gameau as he embarks on a global journey to explore what the world might look like in the year 2040 if existing climate solutions are fully implemented today. The film is structured as a personal message to his young daughter, blending factual investigation with a hopeful vision of the future shaped by conscious choices.

As Gameau travels across different countries, he meets scientists, farmers, policymakers, entrepreneurs, and community leaders who are already implementing sustainable practices. The narrative explores key areas such as renewable energy systems, regenerative and localised food production, circular economies, smart cities, and clean transportation. Each solution is grounded in current research and technology, demonstrating that the tools to combat climate change already exist.

The film contrasts present-day environmental challenges with future scenarios that show how societies could function if governments, industries, and individuals act responsibly. Through animation, expert insights, and real-world case studies, 2040 illustrates how shifts in policy, innovation, and everyday behaviour can lead to healthier ecosystems, resilient economies, and improved quality of life. Rather than focusing on fear or catastrophe, the plot builds an optimistic narrative that emphasizes hope, human ingenuity, and the power of collective action in shaping a sustainable future.

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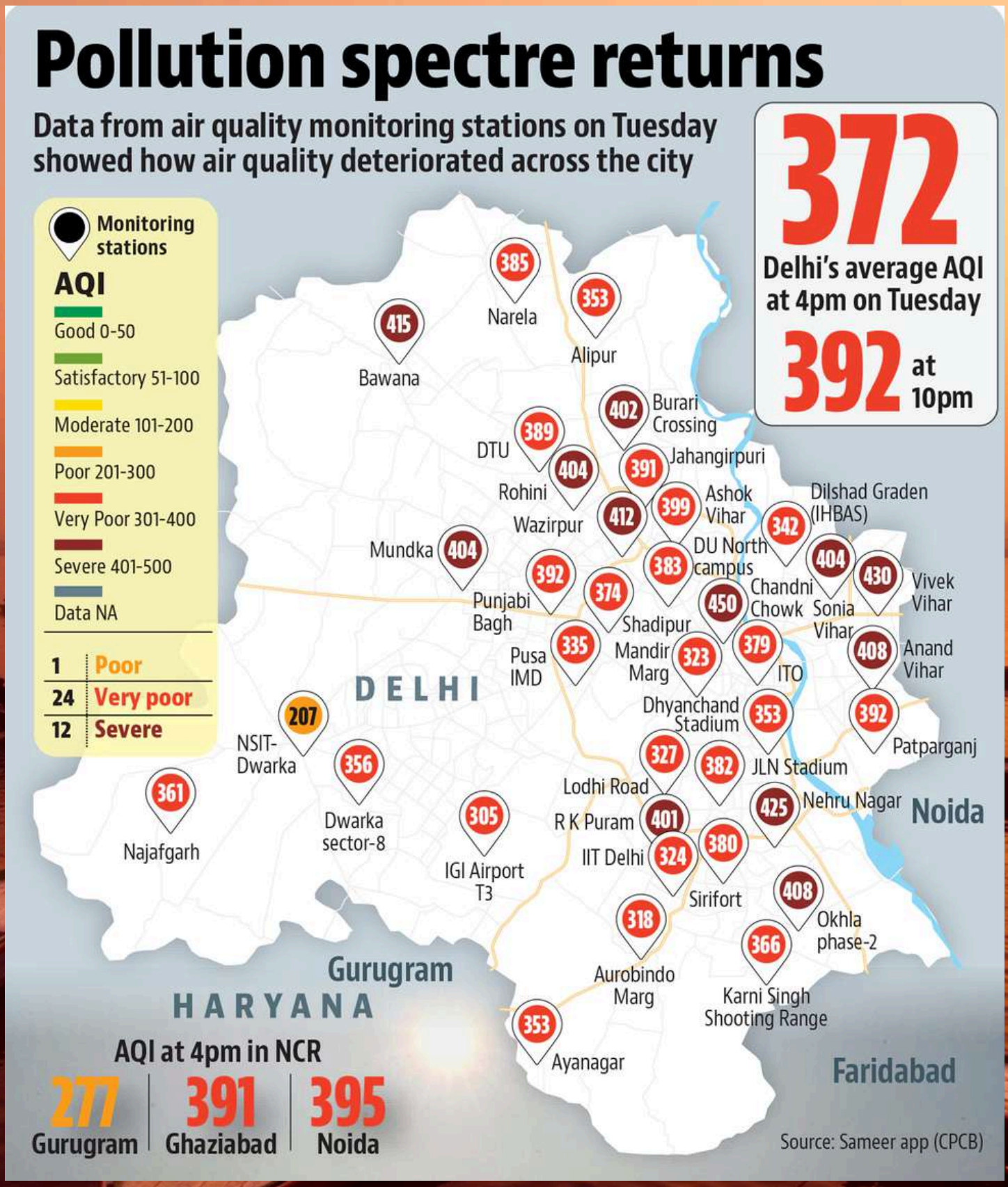

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