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EDITORIAL ANALYSIS

Not the Rain: Kerala's Floods Are a Land-Use Failure

 DOWN TO EARTH

5 August 2026

ENVIRONMENT

GEOGRAPHY

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GS3



INTERVIEW ANGLE

"The Gadgil report was scientifically stronger and politically impossible; the Kasturirangan report was politically survivable and ecologically weaker, and neither has been implemented. If you were asked to produce a third report, what would you do differently to avoid the fate of both?"

✓ Every fact web-verified against primary sources

THE LIFT LINE

Kerala is not getting more rain. It is getting less, in harder bursts, on ground that has lost the ability to hold it. Only the bursts are beyond the state's control.

WHY THIS EDITORIAL MATTERS FOR YOUR EXAM

Disaster questions are usually answered with the NDMA structure, the Sendai Framework and a gesture at preparedness. This supplies a physical mechanism, the difference between rainfall volume and rainfall intensity mediated by infiltration rate, that converts a generic answer into a technical one, and it transfers directly to urban flooding in Chennai, Mumbai and Bengaluru, where the same argument holds with concrete substituted for paddy.

GS Paper 1: Important geophysical phenomena; changes in critical geographical features including water bodies; climatology; distribution of key natural resources.

GS Paper 3: Disaster and disaster management; conservation and environmental degradation; land reforms and land use.

CONCEPT	MEANING	WHY IT IS TESTABLE
Infiltration rate	The rate at which soil can absorb water, set by permeability	Rainfall above this rate becomes runoff regardless of soil dryness
Detention basin	An area that temporarily stores flood water and releases it slowly	The function paddy fields and wetlands performed without being designed for it
Catchment lag time	Interval between rainfall in a catchment and peak flow downstream	Very short in Kerala because rivers are short and steep
Wetland (Conservation and Management) Rules, 2017	The central framework for wetland protection	Read alongside Kerala's own 2008 statute
Gadgil report (2011)	Western Ghats Ecology Expert Panel; proposed extensive ecologically sensitive area coverage in three graded zones	The stronger and politically rejected option
Kasturirangan report (2013)	High Level Working Group; proposed a much smaller ecologically sensitive area confined to natural landscape	The weaker and still unimplemented compromise

BACKGROUND AND CONTEXT

The author is **K. A. Shaji**, writing in Down To Earth on 5 August 2026.

The **empirical** starting point is stronger than a hedge allows. Kerala's monsoon rainfall has **not risen at all**. On the Ministry of Earth Sciences' *Assessment of Climate Change over the Indian Region* (2020), summer monsoon precipitation **declined by about 6 per cent between 1951 and 2015, with notable decreases over the Western Ghats**. What has changed is distribution: longer dry spells punctuated by shorter, more intense wet spells, with widespread extreme rain events over central India and parts of the Ghats up **threefold since 1950**, driven by surges of moisture from a warming Arabian Sea.

So the position is not that more rain is falling on a damaged landscape. It is that **less rain, arriving in harder bursts, is producing worse floods**, which makes the absorption question unavoidable rather than merely arguable.

Kerala flooded again in **late July and early August 2026**. Between 31 July and 2 August the state recorded **13.9 cm of rain against a normal of 4 cm**, more than three times normal, with **Vadasserikkara in Pathanamthitta recording 361 mm in 24 hours**. As of 5 August the toll stood at **28 dead and four missing**.

The **2018 floods** remain the reference point: the most severe the state had recorded in nearly a century, with over 400 deaths. They did **not** produce a judicial commission of inquiry, and describing the aftermath that way is a common error. What they produced was a **Post Disaster Needs Assessment** in October 2018, the **Rebuild Kerala Development Programme** that followed from it, and an **amicus curiae report to the Kerala High Court in 2019** by senior advocate Jacob P. Alex, which found that **none of Kerala's 79 dams had been operated for flood moderation**, that reservoir storage was held high into the first week of August, that no integrated operation on scientifically derived rule curves existed, and that flood warning systems were absent. It recommended a fuller inquiry headed by a former Supreme Court judge.

The State Government moved the High Court to reject that report. The charge in this editorial is that the findings were absorbed rhetorically and never administratively, and the state's own response to the amicus report is the clearest evidence for it.

THE CORE ARGUMENT / ISSUE

Why intensity matters more than volume

This is the mechanism, and getting it right is the difference between a good answer and a general one.

The intuitive account is that rain arrives faster than soil can absorb it and the excess runs off the surface. That mechanism, **infiltration-excess or Hortonian overland flow**, is real, and it is what produces urban flooding on concrete. **It is not what happens in the Western Ghats**, and getting this right matters, because the correct mechanism is far more sensitive to land use than the intuitive one.

These are steep, deeply weathered, forested catchments with **high infiltration capacities**. Measurement across sites in the Sahyadri ranges has found true infiltration-excess overland flow confined to **small degraded or grassy patches**, with Horton's model failing to explain streamflow behaviour in this high-rainfall terrain. Most water goes **into** the ground and travels downslope as **subsurface stormflow**, frequently through natural **soil pipes**, a tunnel-erosion phenomenon documented specifically in Kerala's lateritic highlands and implicated in slope failure and **subsidence**.

The governing process is therefore **saturation**, not exclusion. Weeks of antecedent monsoon rain fill the soil mantle; **pore-water pressure builds at the soil-bedrock interface**; shear strength collapses; the slope lets go.

This inverts one intuition entirely. **Dry soil has higher initial infiltration capacity**, because strong matric suction draws water in, so a dry profile initially generates *less* runoff, not more. Antecedent wetness is not incidental to Kerala's floods and landslides; it is the **precondition** for them. Analysis of 225 rainfall-triggered landslides in Idukki between 2010 and 2018 concluded that **antecedent rainfall, not any single day's total, explains their occurrence**, and cumulative rainfall over 10 to 40 days predicts failure better than daily intensity. World Weather Attribution's own account of the Wayanad disaster records that the rain fell on soils **already saturated by two months of monsoon**.

Why this strengthens the argument rather than weakening it: infiltration-excess flow depends mainly on rainfall intensity, which policy cannot touch. **Saturation and pore-pressure mechanisms depend on the depth, structure and drainage of the soil mantle and on what sits above it**, all of which forest cover, slope cutting and quarrying directly change. Removing forest and cutting slopes shortens the drainage path, concentrates subsurface flow and lowers the **threshold** at which the mantle fails.

The redistribution of the same annual total into fewer and heavier events therefore produces substantially more damage with no increase in rainfall at all, because the soil mantle reaches saturation sooner and stays there longer. That disposes of the objection that rainfall has not increased, which is the objection most commentary treats as decisive.

What Kerala lost

Kerala's flood-absorption infrastructure was overwhelmingly **natural and incidental**, which is why its removal attracted no infrastructure debate.

FEATURE	FUNCTION PERFORMED	WHAT HAPPENED
Paddy fields	Detention basins holding water and releasing it slowly; recharge zones	Reclaimed and filled for construction. The Kerala Conservation of Paddy Land and Wetland Act, 2008 (Act 28 of 2008) was meant to stop this; the 2018 amendment substantially weakened it, on which see below
Wetlands and backwaters	Storage and slow conveyance	Encroached and filled
Hill-slope soil profile	Interception, root-zone storage, slowed downslope flow	Cut for quarrying, road-building and construction on steep gradients
Western Ghats forest	Canopy interception, litter layer, infiltration on the runoff-generating upper catchment	Fragmented by plantation, settlement and linear infrastructure
Canals and drains	Conveyance away from settlement	Encroached, silted and built over

The recurring feature is that each of these performed a flood-management function **without having been built as flood management**, which meant no agency owned it, no budget line protected it, and its loss appeared in no infrastructure account.

Why topography compresses everything

Kerala sits between the Western Ghats and the Arabian Sea, a strip between **35 and 120 km wide** along a coastline of about **580 km**, covering some 38,863 sq km. It has **44 major rivers**, meaning those at least 15 km long, of which **41 flow west** into the Arabian Sea; the three that flow east, the **Kabini, Bhavani and Pambar**, are all tributaries of the Cauvery.

The dimensions are the point. The longest river, the **Periyar**, runs **244 km**; the **Bharathappuzha**, at 209 km, is shorter but has the **largest basin** at 6,186 sq km, which is why it is often described incorrectly as the longest. More telling than either is the distribution: Kerala's rivers **average just 64 km**, and **33 of the 44 run under 100 km** from the Ghats to the sea.

The consequence is a very short **catchment lag time**. Where a large basin gives days of warning between upstream rainfall and downstream peak, Kerala gives hours. A 64 km river descending from the Ghats has almost no floodplain in which to spread and almost no residence time in which to **attenuate** a peak. That has two implications a strong answer should draw out.

Warning systems have limited headroom. Even a perfect forecast converts into a very short evacuation window when the lag is measured in hours.

Upstream retention is worth more than downstream response. Because there is so little time to react, capacity that holds water in the catchment is disproportionately valuable relative to capacity that responds to it on the plain. That is an argument for restoring absorption rather than for buying more rescue equipment, and it runs against the political economy of disaster spending, which favours the visible response over the invisible prevention.

Where the counter-argument is strong

The climate signal is real, and the attribution evidence is genuinely mixed. This is worth stating precisely, because both sides of the public argument overstate it.

World Weather Attribution found the rainfall that triggered the **Wayanad landslides of 30 July 2024**, which killed more than 230 people, about **10 per cent more intense** because of warming, with a further 4 per cent expected at 2 degrees. The study flagged **high uncertainty**, given the complex rainfall dynamics of a small mountainous region. Notably, the same study identified a **62 per cent reduction in forest cover** in the affected region, and quarrying for building materials, as contributors to slope susceptibility, which makes it a citation for the land-use thesis rather than against it.

But a 2023 study in *Environmental Research Letters* found that **anthropogenic** climate change made the **2018 Kerala flood less likely, not more**, attributing this to weakening South Asian monsoon low-pressure systems. Two major Kerala events, attributing in opposite directions. Anyone asserting that climate change simply causes Kerala's floods is going beyond the evidence, and so is anyone denying the signal.

Dam operation is a genuine variable. Reservoirs serve irrigation and power, which argue for keeping them full, and flood moderation, which argues for keeping cushion. A reservoir filled early in the season has little room later, and rule curves that resolve this trade-off are a real management question rather than a distraction. Sequential releases from multiple reservoirs into the same short river system compound the problem further.

The statute was weakened rather than merely unenforced. This distinction matters, because “the law exists but is ignored” and “the law was amended to permit what it prohibited” call for different remedies. The **2018 amendment** to the 2008 Act, Act 29 of 2018, created a new category of “**unnotified land**”, meaning land recorded as paddy or wetland in the Basic Tax Register but absent from the data bank that local committees were supposed to compile. It then inserted **Section 27A**, allowing the owner of such land to apply to the **Revenue Divisional Officer** for conversion to residential or commercial use **on payment of a fee**, bypassing the District Level Authorised Committee entirely. The data bank had been compiled incompletely and with errors; the amendment converted that administrative gap into a legal **entitlement**. The Supreme Court held in *The Tahsildar v. Renjith George* (May 2025) that these amendments cannot operate retrospectively, but the prospective effect stands.

Restriction is distributive, not technical. This is why the expert reports failed, and it deserves stating plainly. Kerala has very high population density, very high land prices and sustained **remittance-funded** housing demand. A restriction on hill-slope construction is a restriction on the principal asset-building route available to a large number of households. The **Gadgil report (2011)** proposed extensive ecologically sensitive area coverage in three graded zones and was politically rejected. The **Kasturirangan report (2013)** proposed a much smaller area confined to natural landscape, and became the basis for **seven successive draft notifications**: March 2014, 2015, 2017, 2018, 2022, **31 July 2024**, and most recently **27 July 2026**, nine days before this edition, covering 56,825.7 sq km across six states.

Not one has ever been finalised. Twelve years, seven drafts, no notification. Successive National Green Tribunal deadlines, March 2020 and December 2020, lapsed, and the expert committee examining state objections now has tenure running to July 2027.

Two details make the deadlock sharper than a simple Centre-versus-states story. Kerala’s ESA extent in the current draft, **9,993.7 sq km**, is **Kerala’s own figure**, produced by the state’s Oommen V. Oommen committee, which cut the Kasturirangan proposal for Kerala by about a quarter; the Centre accepted it. And Kerala is now pressing for the **exclusion of all human habitation and agricultural land** from the ESA altogether.

The most telling fact is the timing of the sixth draft: it issued on **31 July 2024, the day after the Wayanad landslides**. Even a disaster that killed more than 230 people did not break the deadlock, and the seventh draft two years later is substantively unchanged in area. The stronger report was unacceptable and the weaker one has proved unimplementable, which suggests the obstacle is not the content of either.

HOW TO THINK ABOUT THIS (ANALYTICAL FRAME)

When a service is performed incidentally by something that was never designed to perform it, its loss will be invisible in every account until the service fails. Paddy fields storing floodwater, mangroves absorbing storm surge, urban lakes buffering runoff, hedgerows fragmenting fuel loads, informal drainage channels conveying monsoon flow: each is doing work no agency has been assigned and no budget records. Because the service is unowned and unpriced, converting the land to a use that is owned and priced looks like an unambiguous gain, right up to the point of failure. The diagnostic question for any land-use change is not what the land will now produce but what it was quietly producing before.

THE DIAGRAM IN WORDS

Picture a steep green slope with a sponge lying across it, and below the sponge a shallow bowl, and below the bowl a narrow channel running quickly to the sea. Rain falls; the sponge takes most of it; what escapes collects in the bowl and drains away slowly; the channel carries a manageable flow. Now, over thirty years, cut pieces out of the sponge for a quarry and a road and some houses. Fill the bowl and build on it, because it is flat land and flat land in Kerala is valuable. Narrow the channel where it passes a town. The rain has not changed much, but it now arrives in shorter, harder bursts. What is left of the sponge saturates in an hour, there is no bowl at all, and the same water that used to take three days to reach the sea arrives in one afternoon, through a channel half its old width, in a town built on the place the water used to sit.

WAY FORWARD

- ① **Treat absorptive capacity as infrastructure with a budget line**, so that paddy land, wetland and drainage restoration compete for funds on the same basis as embankments and rescue equipment.
- ② **Enforce the Kerala Conservation of Paddy Land and Wetland Act, 2008 through restoration**, requiring reversal of unlawful reclamation rather than levying a penalty and permitting the fill to remain.
- ③ **Zone by hazard, not by category**, using slope, soil and flood-history mapping to restrict construction on steep gradients and in floodplains, with the mapping published so that it constrains permission at the point of grant.
- ④ **Restore encroached drainage and canal networks**, which is the cheapest single intervention available and the one most often deferred because it produces no new asset.
- ⑤ **Revisit reservoir rule curves** to preserve flood cushion through the monsoon, with coordinated operation across reservoirs feeding a common river, and publish the operating rules so that releases are predictable.

- ⑥ **Replace the failed uniform ecologically-sensitive-area designation with graded, village-level regulation** negotiated through local bodies, on the reasoning that a rule which is locally agreed and partially strict will outperform a rule that is scientifically ideal and never enforced.
- ⑦ **Apply the framework to Indian urban flooding generally**, since Chennai, Mumbai and Bengaluru present the same structure with concrete substituted for paddy and stormwater drains for backwaters.

PYQ LINKAGE AND PRACTICE

UPSC has tested Kerala's floods, Western Ghats ecology, the Gadgil and Kasturirangan reports, wetland conservation and urban flooding across GS1 and GS3. The infiltration-rate mechanism and the incidental-service frame are what allow those to be written as one argument rather than as separate recollections.

Practice question: “The same annual rainfall delivered in fewer and heavier events, onto a landscape that has lost its absorptive capacity, produces flooding without any increase in rainfall at all.” Examine this claim with reference to Kerala, and assess why successive expert recommendations on Western Ghats land use have not been implemented. (250 words, 15 marks)

Interview angle: The Gadgil report was scientifically stronger and politically impossible; the Kasturirangan report was politically survivable and ecologically weaker, and neither has been implemented. If you were asked to produce a third report, what would you do differently to avoid the fate of both?

Sources: Down To Earth, Ministry of Environment, Forest and Climate Change, India Meteorological Department

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• KEY ARGUMENTS AT A GLANCE

Kerala's recurrent flooding is a land-use failure rather than a rainfall anomaly: monsoon rainfall over the Western Ghats has declined by roughly 6 per cent since 1951 rather than risen, but its delivery has shifted from steady distribution across the monsoon to short intense bursts, and a landscape that has lost its absorptive capacity through forest fragmentation, reclamation of paddy and wetland, unregulated construction and neglected drainage cannot accommodate the same volume arriving faster.



SUPPORTING

- The distinction is between rainfall volume and rainfall distribution rather than between wet years and dry ones: monsoon rainfall over the Western Ghats has, if anything, declined, with the Ministry of Earth Sciences recording a fall of about 6 per cent over 1951 to 2015, while the same total now arrives in longer dry spells punctuated by shorter, more intense wet spells. The mechanism that matters in these catchments is not surface runoff but saturation: weeks of antecedent monsoon rain fill a deep weathered soil mantle, pore-water pressure builds at the soil-bedrock interface, and slopes fail.
- Kerala's absorptive infrastructure was substantially natural and has been substantially removed: paddy fields and wetlands that functioned as detention basins have been filled for construction despite the Kerala Conservation of Paddy Land and Wetland Act, 2008, laterite hill slopes have been cut for quarrying and building, and forest fragmentation in the Western Ghats has reduced canopy interception and root-zone storage on the steep upper catchments where runoff generation begins.
- The state's topography compresses the consequences: its 44 major rivers average just 64 km and three-quarters run under 100 km from the Ghats to the Arabian Sea across a strip 35 to 120 km wide, so the interval between rainfall in the catchment and flooding on the coastal plain is measured in hours rather than days, which leaves almost no operational warning window and makes upstream retention far more valuable than downstream response capacity.



COUNTER

The land-use account should not be pushed into denying the climate signal, though the attribution evidence is more mixed than either side usually admits. World Weather Attribution found the rainfall that triggered the Wayanad landslides of July 2024 about 10 per cent more intense because of warming, while flagging high uncertainty in a small mountainous region;

but a 2023 study in Environmental Research Letters found anthropogenic climate change made the 2018 Kerala flood event less likely rather than more.

Extreme rain events over central India and parts of the Ghats have risen threefold since 1950, driven by surges of moisture from a warming Arabian Sea, so the hazard has changed even where total rainfall has not. Dam operation is also a genuine variable rather than a distraction, since reservoirs filled early in the season have limited flood cushion later, and this is a management question with real trade-offs against irrigation and power.

And restriction of construction in a state with Kerala's population density, land prices and remittance-funded housing demand is not a technical decision but a distributive one, which is precisely why successive expert committees have not been implemented.



WAY FORWARD

Treat absorptive capacity as infrastructure and fund it as such: enforce the paddy-land and wetland statute with restoration rather than only penalty, restrict construction on steep slopes and in floodplains through enforceable zoning tied to hazard mapping, restore drainage and canal networks that have been encroached, revisit reservoir rule curves to preserve flood cushion through the season, and resolve the Gadgil-Kasturirangan impasse by shifting from a uniform ecologically-sensitive-area designation to graded, village-level regulation negotiated with local bodies.


MAINS ANSWER FRAMEWORK
QUESTION

Examine the proposition that recurrent flooding in Kerala is primarily a consequence of land-use change rather than of increased rainfall, and assess why the recommendations of successive expert committees have not been implemented. (250 words)

INTRODUCTION

Kerala's flooding is routinely reported as a rainfall event, which invites the response that little can be done about the weather. The more accurate account is that the state's capacity to absorb rainfall has fallen while its rainfall has not risen at all, and that framing identifies interventions the state can actually make.

BODY

Three mechanisms operate together. The first is the change in rainfall delivery.

Annual totals have not risen dramatically over recent decades, but the distribution has shifted toward fewer and more intense events. The mechanism, however, is not the intuitive one.

In these steep, deeply weathered, forested catchments infiltration capacities are high and true surface runoff is confined to small degraded patches; water enters the ground and moves downslope as subsurface stormflow. Failure comes through saturation, as weeks of antecedent rain fill the soil mantle and pore-water pressure builds at the soil-bedrock interface until shear strength collapses.

That is why antecedent rainfall over 10 to 40 days predicts Kerala landslides better than any single day's total, and why the mechanism is so sensitive to forest cover and slope cutting. The second is the loss of absorptive capacity, which in Kerala was largely natural rather than engineered.

Paddy fields and wetlands that functioned as detention basins have been reclaimed for construction, notwithstanding the Kerala Conservation of Paddy Land and Wetland Act, 2008; hill slopes have been cut for quarrying and building, removing the soil profile that stored water; and forest fragmentation in the upper Western Ghats catchments has reduced canopy interception and root-zone storage where runoff is generated. The third is topography, which compresses the consequences of the first two.

Kerala's rivers run short and steep from the Ghats to the sea, so the lag between catchment rainfall and coastal-plain flooding is a matter of hours, leaving negligible warning time and making upstream retention far more valuable than downstream response. Against this, two honest qualifications.

Attribution science does find intensification of extreme rainfall in this region, so the hazard has genuinely changed; and reservoir operation is a real variable, since a dam filled early for irrigation and power carries less flood cushion later. The post-2018 assessments, the Post Disaster Needs Assessment, the Rebuild Kerala programme and the amicus curiae findings that none of the state's 79 dams had been operated for flood moderation, were absorbed rhetorically and not administratively; the State Government in fact moved the High Court to reject the amicus report.

CONCLUSION

The corrective is to treat absorptive capacity as infrastructure with a budget line, rather than as scenery. That means enforcing the paddy and wetland statute through restoration and not only penalty, hazard-based zoning that restricts construction on steep slopes and floodplains, restoration of encroached drainage networks, reservoir rule curves that preserve flood cushion through the season, and a graded village-level replacement for the failed uniform ecologically-sensitive-area designation, negotiated with local bodies rather than announced to them.

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