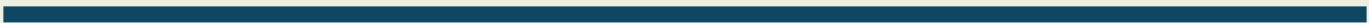# Vanishing Green:India's Battle With Pollution
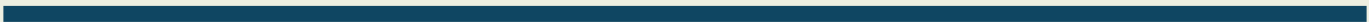
A Data-Driven Analysis of Tree Destruction & Environmental Impact (2010–2023)

Project Objective

This project aims to analyze environmental damage in India from 2010-2023, focusing on tree destruction, pollution incidents, affected regions, causes, and government responses. The goal is to uncover insights that inform policy and action.

Data And Methodology

- This project utilises data from a **Kaggle** dataset spanning 2010 to 2023 to examine the scope and causes of environmental degradation in India.
- The data underwent a cleaning process and was visualized using **Tableau**.
  - The visualisations featured maps, key performance indicators (KPIs), heat maps, bar charts, and pie charts.

Additionally, calculated fields were developed for % of total incidents,% of trees destroyed, average response time.

Key Performance Indicators

Total Trees Destroyed

757,000+

Across 10 Indian states

Pollution Incidents

3,230+

Peaked in 2012: 2023 has partial data

Average AQI (Top 10 States)

-224

Highest: Gujarat (256): Lowest: Kerala (20)

Avg Govt Response Time

-89 Days

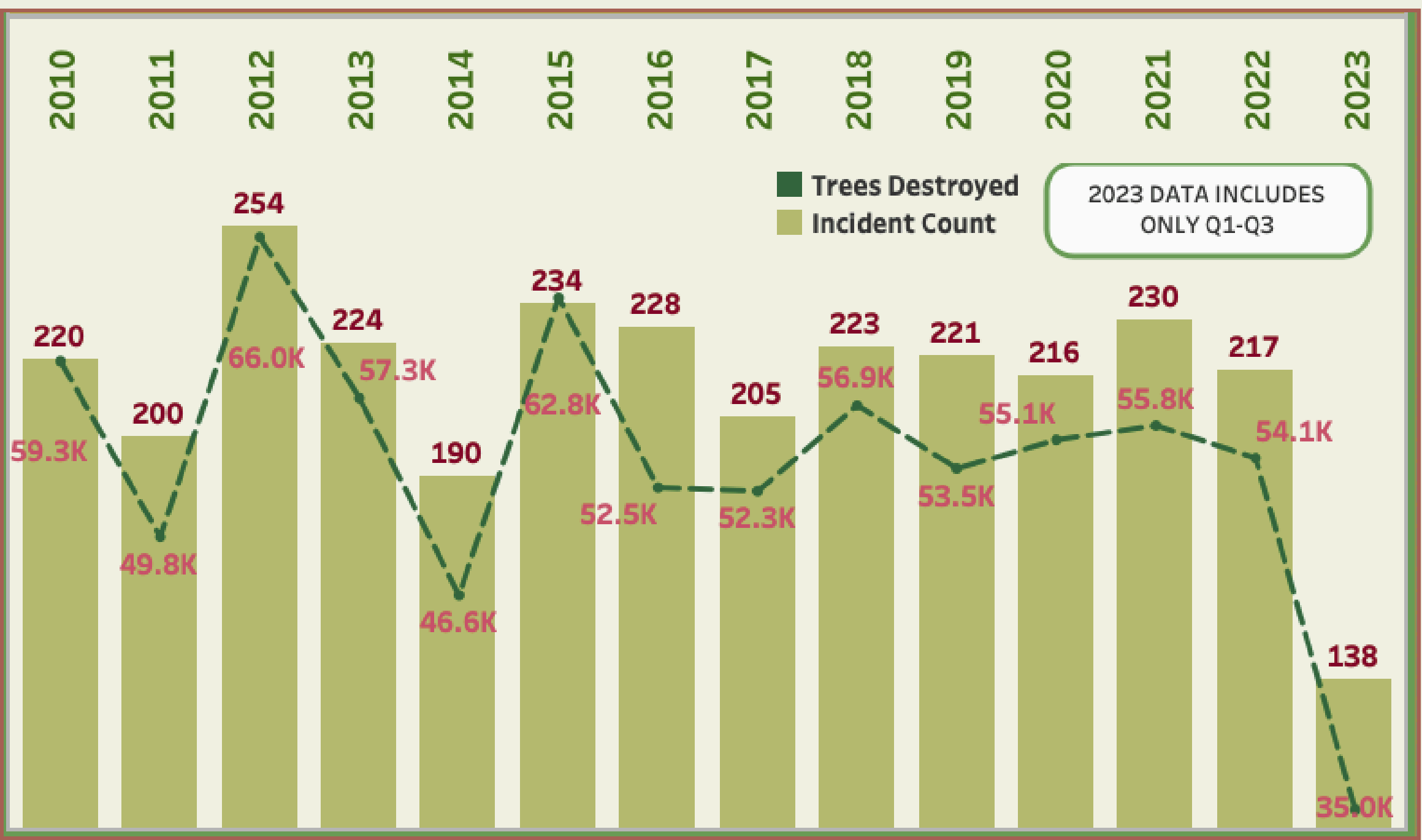Fastast: Maharashtra (85-6 days): Slowest: Punjab (95.4 days)

Recovery Rate (Avg)

Recovered: 33%

Illegal Dumping has the highest "Unrecovered' rate

Trends in Trees Destroyed and Incident Count (2010–2023)

- **Observed Correlation:**
  - Years with a higher number of pollution incidents generally experience greater tree loss (e.g., 2012, 2015).

- **Incomplete Drop in 2023:**
  - The year 2023 shows a decline in both metrics; however, this is primarily due to data being available for only three quarters

- **Complex Causation:**
  - Pollution can harm trees through air, water, and soil contamination.
  - The destruction of trees can worsen pollution, leading to a decrease in natural air filtration.

- **Likely Feedback Loop:**
  - These two factors may reinforce each other, resulting in a cycle of environmental degradation.

Geographic & Cause Analysis
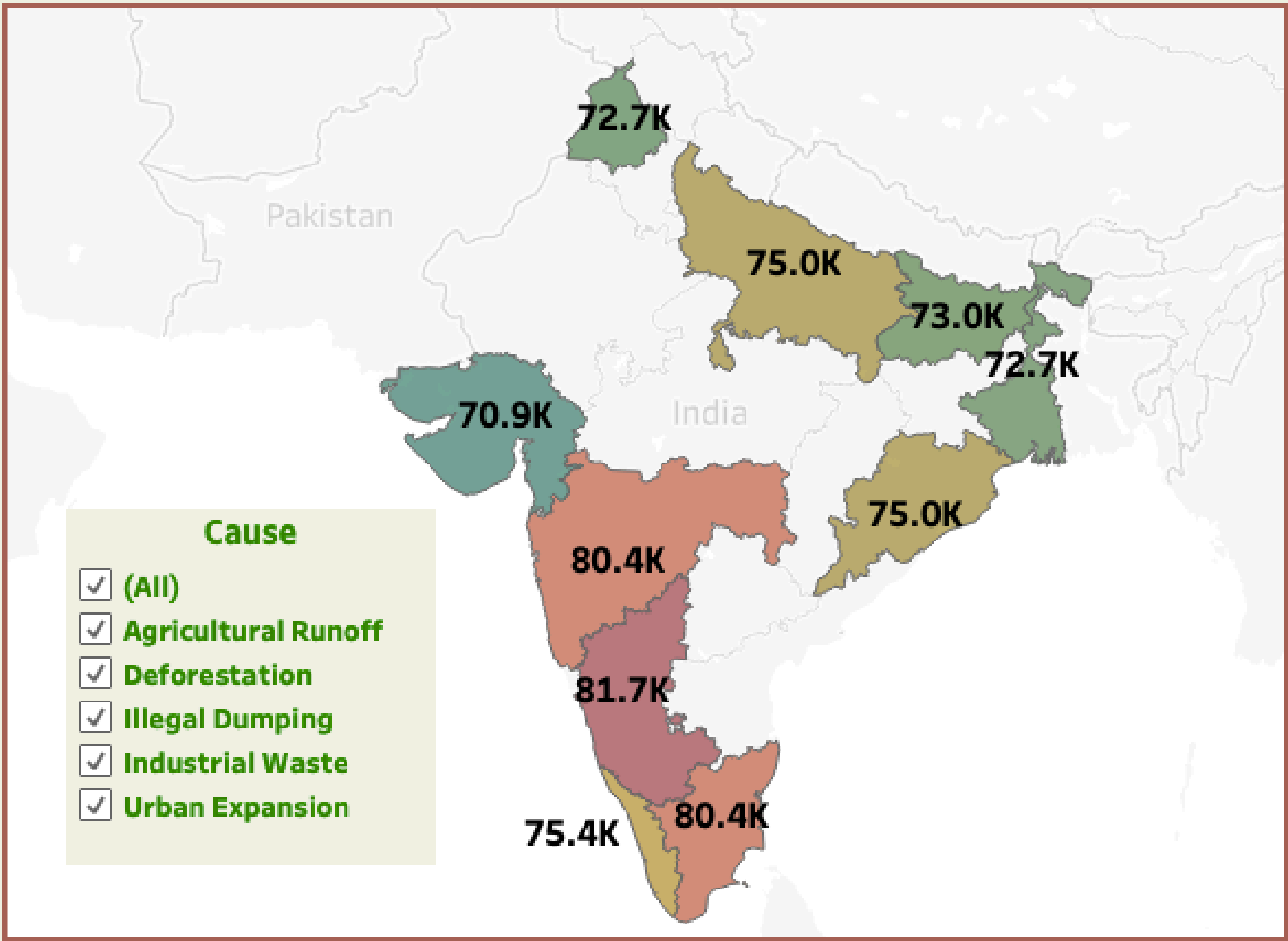
Top 3 Causes of Tree Destruction:
1. Agricultural Runoff – 153,785 trees
2. Industrial Waste – 153,813 trees
3. Illegal Dumping – 153,187 trees

- Deforestation and urban expansion are closely following these causes, indicating that various human activities contribute almost equally to tree loss.
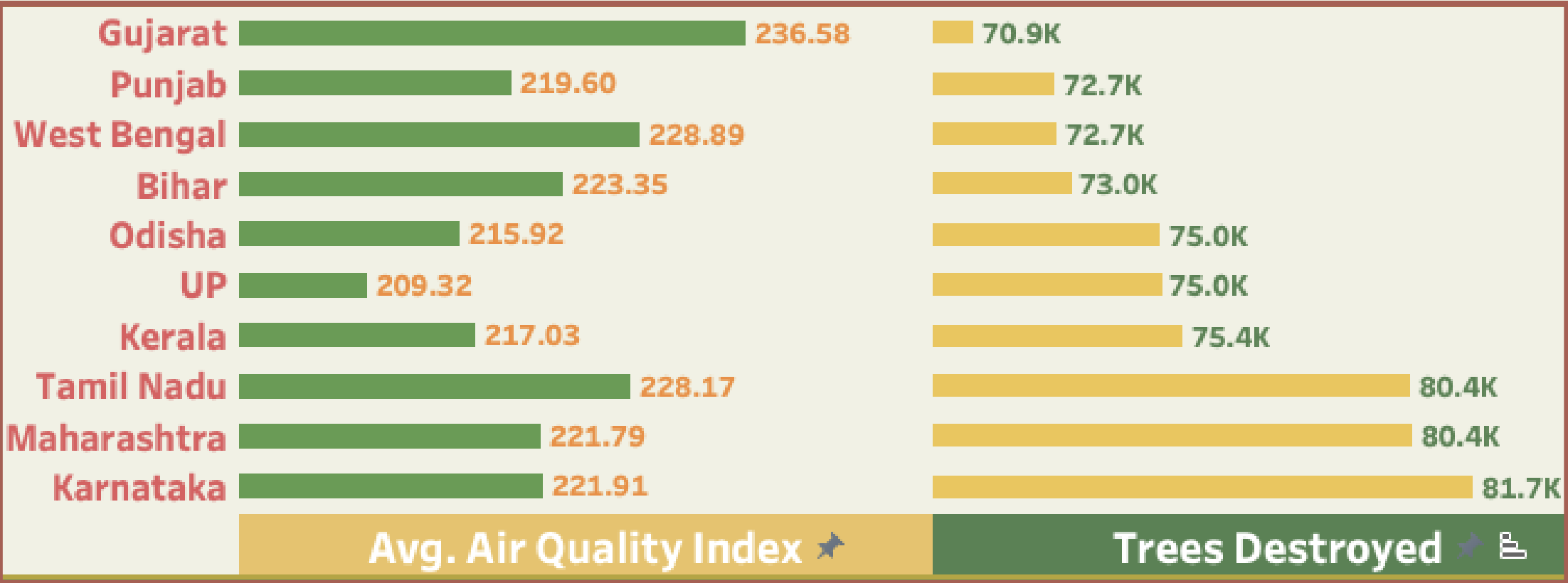
State Hotspots:

- Maharashtra, Tamil Nadu, Karnataka, and Kerala consistently report high destruction figures across all causes.
- Kerala particularly experiences significant losses due to illegal dumping (20,780 trees) and agricultural runoff (13,684 trees).
- West Bengal and Odisha show comparatively lower figures but are still present in all categories.

Multifactor Pressure:

- The data indicates that tree loss is not solely caused by one major factor; rather, it results from a combination of multiple environmental threats across different states.

Exploring Connection Between Tree Loss and AQI Of States

Gujarat | 236.58 | 70.9K
Punjab | 219.60 | 72.7K
West Bengal | 228.89 | 72.7K
Bihar | 223.35 | 73.0K
Odisha | 215.92 | 75.0K
UP | 209.32 | 75.0K
Kerala | 217.03 | 75.4K
Tamil Nadu | 228.17 | 80.4K
Maharashtra | 221.79 | 80.4K
Karnataka | 221.91 | 81.7K

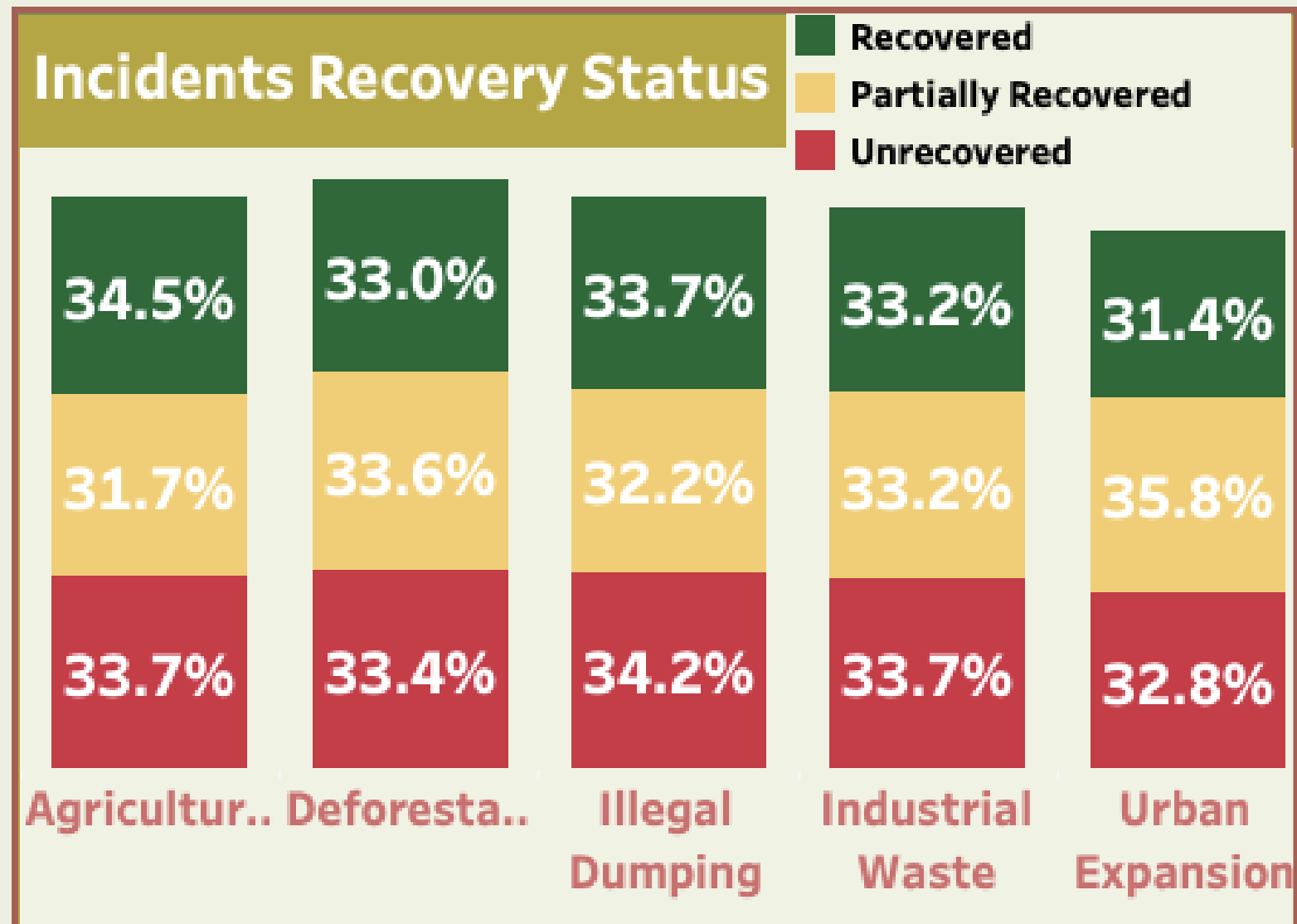**Avg. Air Quality Index** ✦   **Trees Destroyed** ✦ 🗒

- **Gujarat** has the highest AQI (236.6) but not the highest tree loss pointing to non-forest related pollution like industrial emissions or urban traffic.

- **Karnataka and Maharashtra** show both high tree loss and moderately high AQI, suggesting a combined effect of deforestation and pollution.

- **Uttar Pradesh** shows moderate tree loss but best air quality (AQI 209) possibly due to better vegetation cover in key areas or lower industrial density.

- There is no perfect one-to-one correlation, reinforcing the idea that air pollution is multi-causal, though tree destruction does amplify its impact.

Wildlife Loss Across Pollution Causes
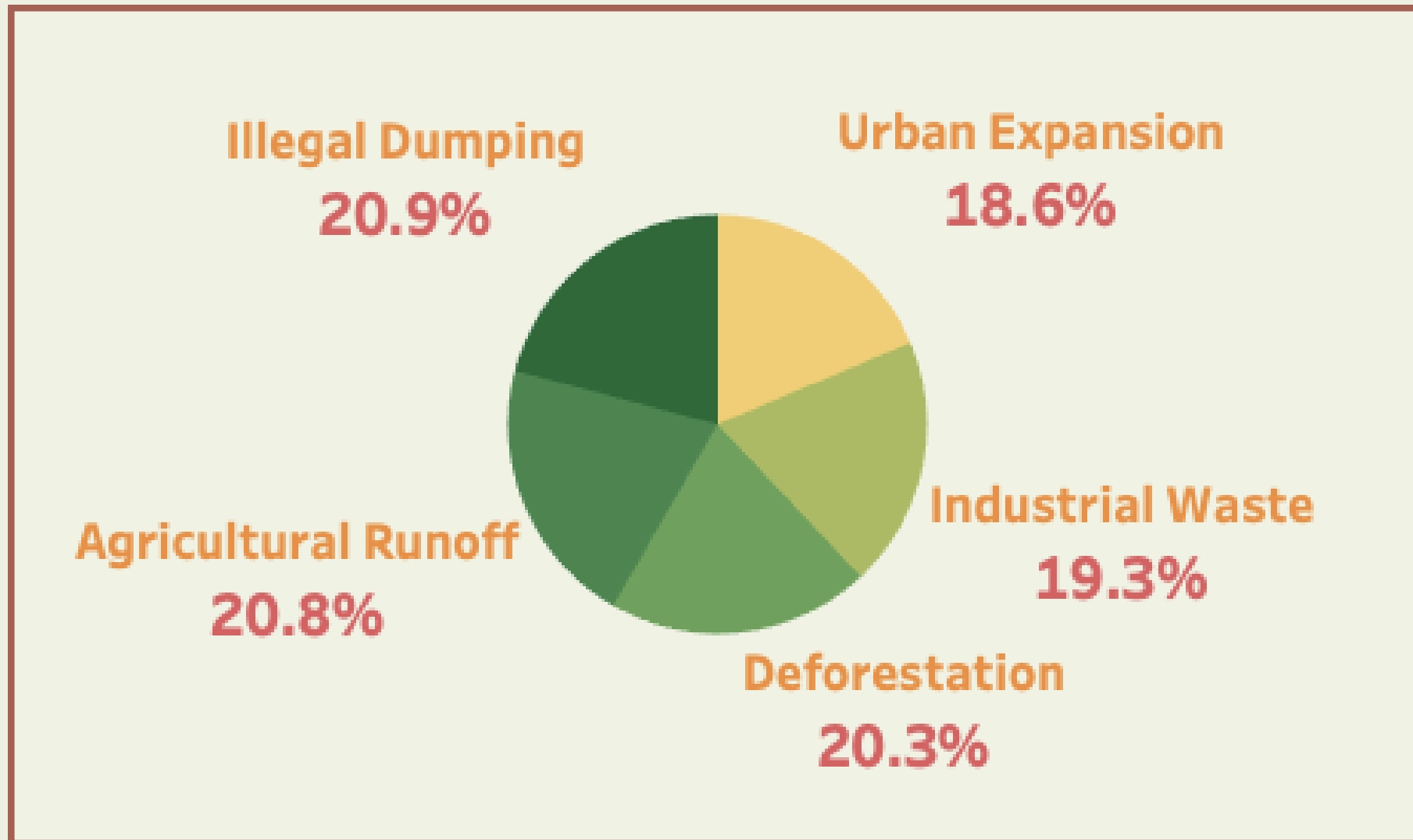
- **Illegal Dumping** is the most detrimental to wildlife, impacting over 93k+ animals, likely due to toxic exposure and habitat contamination.

- **Agricultural Runoff** follows closely, leading to losses of more than 92.8k+ wildlife, primarily from pesticides and fertilizers infiltrating ecosystems.

- **Urban Expansion and Industrial Waste** together account for over 38% of the total wildlife impact, highlighting the cumulative effects of unplanned development.

- Each of the five causes independently results in over 80K+ wildlife losses, emphasizing that no single factor can be overlooked in policy interventions.

Which Environmental Damages Are Hardest To Recover From?

Incidents Recovery Status

Legend:
- Recovered
- Partially Recovered
- Unrecovered

	Agricultur..	Deforesta..	Illegal Dumping	Industrial Waste	Urban Expansion
Recovered	34.5%	33.0%	33.7%	33.2%	31.4%
Partially Recovered	31.7%	33.6%	32.2%	33.2%	35.8%
Unrecovered	33.7%	33.4%	34.2%	33.7%	32.8%

- **Urban Expansion** exhibits the lowest full recovery rate at 31.4%, coupled with the highest partial recovery rate of 35.8%, indicating that restoration tends to be slow or limited once urbanization occurs.

- **Illegal Dumping** presents the highest percentage of unrecovered cases at 34.16%, suggesting that full cleanup and restoration may prove challenging.

- **Industrial Waste and Deforestation** demonstrate a nearly equal distribution across various recovery statuses, each around 33%, reflecting moderate recovery success while still facing ongoing challenges.

- **Agricultural Runoff** boasts the highest recovery rate at 34.5%, indicating that it may be more manageable with enhanced practices and policies.

State-wise Environmental Pressures by Pollution Type

	Urban Expansion	Industrial Waste	Agricultural Runoff	Illegal Dumping	Deforestation
Gujarat	47	59	63	53	69
Punjab	60	62	54	59	63
West Bengal	59	75	52	45	60
Bihar	43	60	53	60	72
Odisha	65	41	63	81	54
UP	60	61	60	52	57
Kerala	51	46	58	76	62
Tamil Nadu	60	59	66	60	66
Maharashtra	62	68	78	52	59
Karnataka	63	63	58	68	63

Bihar
- Faces the highest impact from deforestation with 72 incidents.
- Notable challenges in all other causes (ranging from 50 to 60), indicating diverse environmental issues.

Gujarat
- High levels of agricultural runoff (63) and deforestation (69).
- Slightly lower in urban expansion (47), but continues to show consistent environmental stress.

Karnataka
- Uniformly high incidents across all causes (each above 60).
- Indicates broad-spectrum pollution threats, from runoff to urbanization.

Kerala
- Leads in illegal dumping with a significant 76 incidents a major concern.
- Lower levels of deforestation and industrial waste (approximately 60 and 46) suggest challenges focused on waste management.

Maharashtra
- Highest in agricultural runoff (78) and significant industrial waste (68).
- Consistent across all causes, indicating high levels of industrial and agricultural pollution.

State-wise Environmental Pressures by Pollution Type

Odisha
- Tops the list for illegal dumping (81) and urban expansion (65).
- Relatively low in industrial waste (41), revealing unmanaged urban growth and waste as key threats.

Punjab
- Lacks extreme values, but all causes hover around 59 to 63.
- Reflects a consistent, medium-level environmental strain.

Tamil Nadu
- Displays balanced environmental pressure across all causes (approximately 60 each).
- No outlier incidents, but steady risks of degradation.

Uttar Pradesh
- Lower incidents in agricultural runoff and illegal dumping (52 each).
- Fairly consistent across other categories, likely due to mixed land use and the urban-rural divide.

West Bengal
- High levels of industrial waste (75) emerge as a standout issue.
- Relatively lower in other causes, likely driven by industrial pollution.

State-wise Pollution Incidents by Pollution Type

	Air	Mixed	Soil	Water
Maharashtra	81	75	81	82
Karnataka	65	75	87	88
Tamil Nadu	80	79	58	94
Odisha	83	68	78	75
Punjab	64	78	75	81
Kerala	73	66	75	79
Gujarat	72	67	74	78
West Bengal	69	72	70	80
UP	80	71	69	70
Bihar	75	76	61	76

- **Tamil Nadu** has the highest water pollution (94) — needs urgent intervention in water quality.

- **Maharashtra** shows high levels across all pollution types (75–82) indicating overall environmental pressure.

- **Odisha and Bihar** show consistently high air and water pollution (75+), hinting at industrial and agricultural pollutants.

- **Karnataka** has highest soil pollution (87) and second-highest water pollution (88) possible links to waste mismanagement and runoff.

- **Punjab** has high mixed pollution (78) and water pollution (81) may be due to combined effects of agriculture and urban discharge.

State-wise Pollution Incidents by Pollution Type
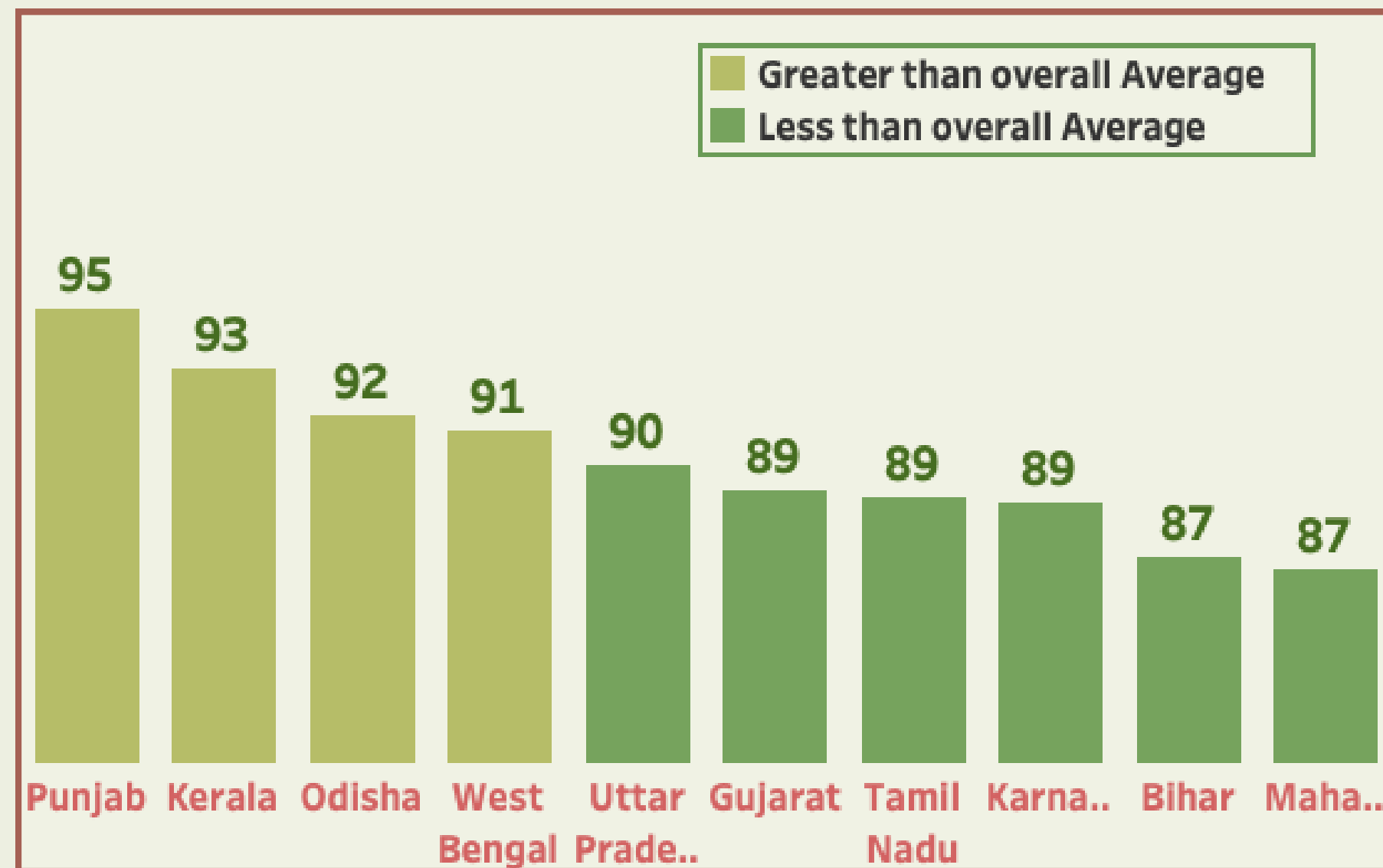
- **Punjab** (95.45 days) has the slowest average response, followed by Kerala (93.49) and Odisha (91.87) — may indicate bureaucratic delays or capacity issues.

- **Maharashtra** (86.61) and **Bihar** (87.02) have the fastest average response times, possibly due to better coordination or more frequent handling of cases.

- Most states fall in a narrow range (86–95 days), suggesting a systemic delay in environmental action.

Government response to pollution incidents takes nearly 3 months on average across states with Punjab and Kerala facing the most delay. Faster response mechanisms are critical for mitigation and recovery.

River Pollution Incidents by Pollution Cause
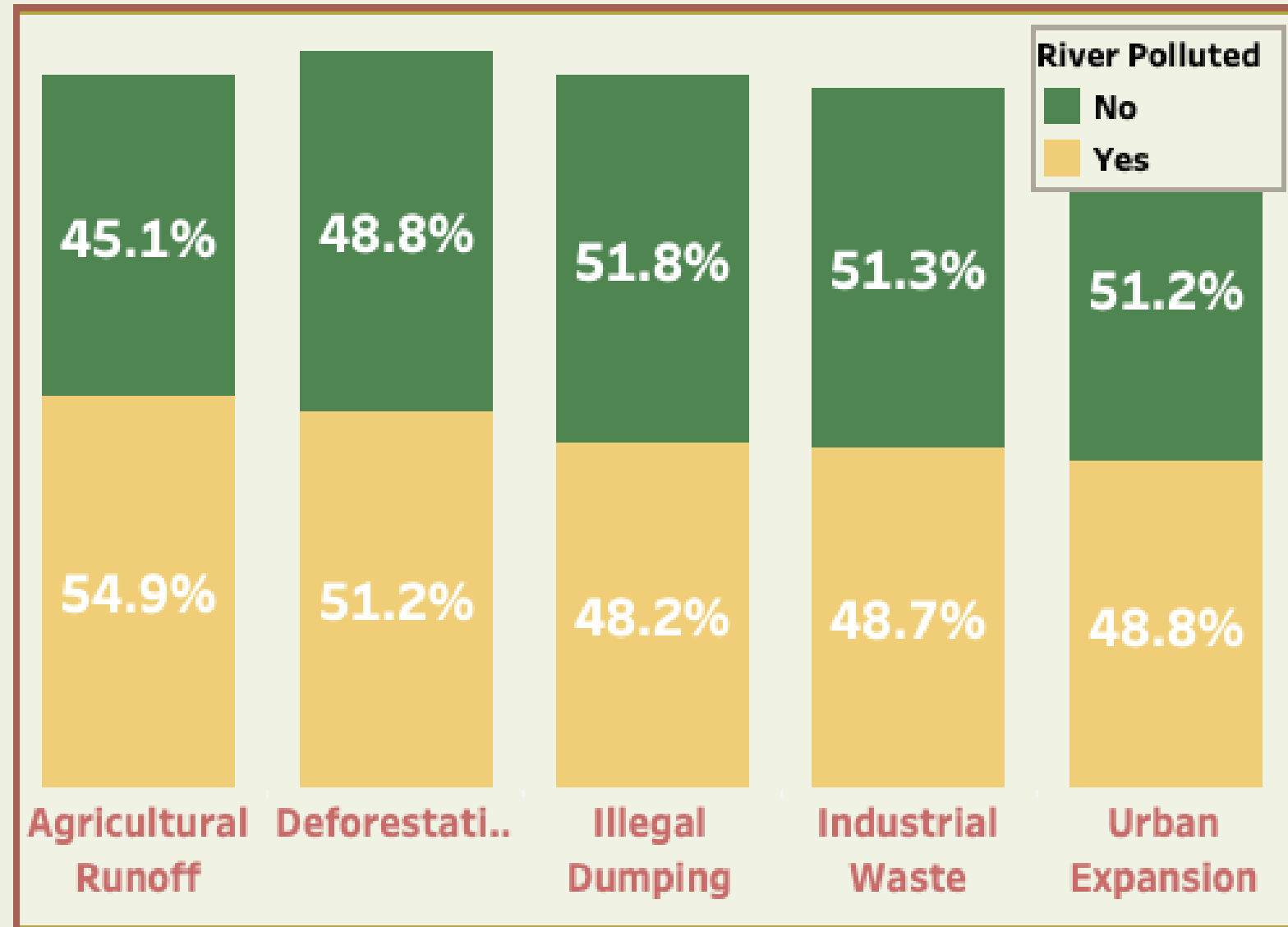
- **Agricultural Runoff** caused river pollution in ~55% of incidents (332 out of 605) the highest proportion among all causes.

- **Deforestation** led to river pollution in ~51% of cases surprising since it's usually linked to land, not water.

- **Illegal Dumping and Industrial Waste** show a rough balance, but still polluted rivers in ~48% of incidents each.

- **Urban Expansion** had river pollution in <49% of cases suggesting mixed impact on waterways.

Key Insights

Pollution Events and Deforestation: A Correlative Crisis

Pollution incidents and tree destruction appear to be correlated, and both may be contributing to a reinforcing cycle of environmental degradation.

The Complexity of Tree Destruction

Tree destruction is a multifaceted issue with no single culprit. Various factors including industrial activities, agricultural runoff, urban sprawl, and ineffective waste management are collectively stressing ecosystems.

The Need for Stronger Restoration Policies

Many environmental damages, particularly deforestation and urban expansion, remain unresolved, emphasizing the necessity for improved restoration policies and long-term planning.

State-Specific Environmental Challenges

Each state possesses a distinct environmental footprint. While some grapple with deforestation, others contend with urban expansion or illegal dumping. Customized, state-specific environmental policies are crucial for effective management.

Key Insights

Notable Cases: Tamil Nadu, Karnataka, and Beyond

Tamil Nadu and Karnataka are highlighted for severe water and soil pollution, respectively. Maharashtra encounters significant environmental pressures across multiple areas, while Odisha and Bihar face challenges with air and water quality.

Government Response Times

On average, government responses to pollution incidents take nearly three months across states, with Punjab and Kerala experiencing the longest delays. Swift response mechanisms are vital for effective mitigation and recovery.

Agricultural Runoff: A Leading Pollutant

Agricultural runoff is the primary cause of water pollution, affecting rivers in over half of the reported incidents. Surprisingly, both deforestation and illegal dumping also contribute significantly to river pollution, underscoring indirect risks to water ecosystems.

Recommendations

Policy and Enforcement

- Implement stricter regulations on agricultural runoff, illegal dumping, and industrial waste, which are major contributors to tree loss and water pollution.
- Launch targeted afforestation initiatives in states experiencing high levels of tree destruction and pollution, such as Maharashtra, Karnataka, and Tamil Nadu.

Technology and Monitoring

- Establish quicker response frameworks by utilising digital reporting and GIS monitoring, aiming to decrease the current average response time of 90 days.
- Employ drones and satellite imagery to identify illegal deforestation and dumping activities at an early stage.
- Enforce environmental impact assessments (EIA) for major infrastructure and land use projects.

AQI

- Focus air quality controls on non-forest emission sources like traffic, industry, and construction
- Introduce urban tree plantation drives specifically in high-AQI districts.
- Couple afforestation with industrial and vehicular emission controls.
- Invest in green urban infrastructure like green roofs, roadside plantations, and low-emission transport.

Recommendations

Water-Specific Interventions

- Create riparian buffer zones and provide incentives for organic farming in states at high risk to mitigate river pollution caused by agricultural practices.
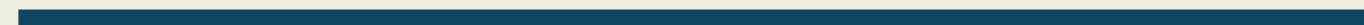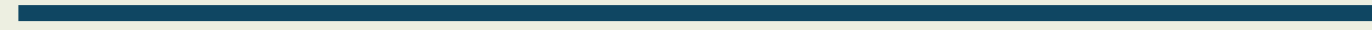
Public Awareness and Incentives

- Conduct awareness campaigns in urban areas regarding the effects of urban expansion and local waste management on recovery efforts and river health.
- Offer tax incentives or subsidies to industries that make proactive investments in green recovery initiatives or low-emission technologies.

Conclusion

•••••

The Tableau dashboard integrates a variety of environmental metrics, including pollution incidents, tree loss, air and water quality, recovery status, and response efficiency.It highlights both macro trends and state-level disparities, enabling data-driven decision-making.

•••••

Thank you