



SUSTAINABILITY OUTLOOK FOR THE KOCASU RIVER DELTAS (2026)

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ABSTRACT

Recent environmental news from 2024–2026 shows that the Kocasu River Basin is experiencing **ecosystem collapse, mass fish deaths, industrial contamination, and tourism decline**, like global delta degradation trends. This updated article integrates **current news, recent ecological alerts, and visual evidence** from the Kocasu River and other deltas worldwide. The study provides a holistic sustainability assessment supported by **recent field photos, pollution imagery, and global delta comparisons**.

KEY WORDS: Delta, Sustainability, Ecological Resilience, Environmental Risk, Delta Ecosystem Dynamics

1. INTRODUCTION

Wetlands worldwide are collapsing under intensifying industrial pressure, and recent global assessments show that this decline is accelerating. According to UNEP (2024), **35% of the world's wetlands have disappeared in just five decades**, a trend driven primarily by industrial expansion, agricultural conversion, pollution, and poorly regulated land-use change. This loss is not only ecological but also economic: international reports warn that the continued degradation of wetlands could result in **up to \$39 trillion in lost ecosystem services by 2050**, including flood protection, water purification, carbon storage, and fisheries productivity.

The situation in Türkiye mirrors these global patterns. **Recent news from Bursa** highlights severe ecological stress in the Kocasu River Basin, where industrial discharge, agricultural runoff, and hydrological alteration have triggered visible ecosystem decline. Reports of **fish kills, water discoloration, and pollution reaching critical reservoirs** indicate that the region is experiencing the same pressures documented worldwide. These local events reinforce the global scientific consensus: wetlands are among the fastest-declining ecosystems on Earth, with **22% lost since 1970**, making them more vulnerable than forests, grasslands, or coral reefs. Together, global assessments and regional observations show that the Kocasu River Delta is not an isolated case but part of a broader planetary crisis in wetland sustainability.

- **Mass fish deaths** in Kocasu (2026) (Photo 1)
- **River ecosystem collapse** reported by local media (2026) (Photo 2)
- **Industrial contamination** reaching Çınarcık Dam (2026) (Photo 3)

These events show that the Kocasu Delta is entering a **critical ecological threshold**, and these images confirm severe hydrological degradation.



Photo 1. Field Photo Showing Fish Deaths (www.guneybursa.com.tr)



Photo 2. Field Photo Showing Pollution (www.olay.com.tr)



Photo 3. Field Photo Showing Industrial contamination (www.memleket.com.tr)

2. STUDY AREA AND GEOGRAPHIC CONTEXT OF THE KOCASU RIVER DELTA

The Kocasu River Delta is located along the southern shoreline of the Marmara Sea, within the administrative boundaries of Karacabey District in Bursa Province, northwestern Türkiye. The delta forms the terminal section of the Kocasu River—also known as the lower Susurluk River—which drains a large watershed originating from the Sındırgı–Dursunbey highlands and flowing northward before entering the Marmara coastal plain. This hydrological system plays a critical role in shaping the geomorphology, ecology, and land-use dynamics of the region (Figure 1).

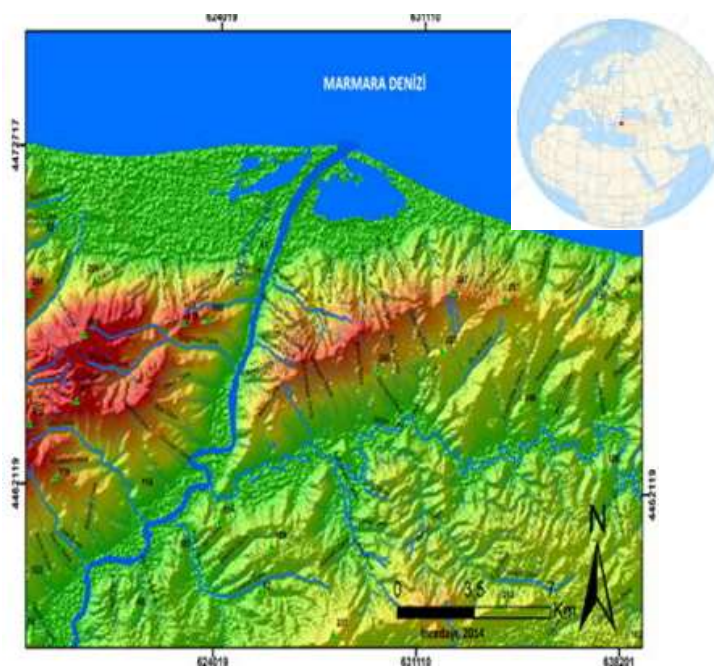


Figure 1. Kocasu River Delta – Location Map

Geographically, the delta lies at the transition between the **Güney Marmara Sub-Region** and the **Marmara coastal ecosystem**, creating a unique interface where fluvial, lacustrine, and marine processes interact. The area hosts a mosaic of wetland environments, including **Dalyan Lagoon**, **Poyraz Lagoon**, and **Arapçiftliği Lagoon**, each functioning as semi-enclosed coastal water bodies that support high biodiversity and serve as critical habitats for migratory birds. Surrounding these lagoons are extensive **longoz (flooded) forests**, sand dune systems, marshes, and agricultural fields, forming a complex ecological landscape.

Topographically, the delta is characterized by low-lying alluvial plains shaped by continuous sediment deposition. The region's geomorphology is influenced by river discharge, seasonal flooding, coastal currents, and wind-driven sediment transport. These processes collectively maintain the dynamic equilibrium of the delta, although recent anthropogenic pressures—such as industrial effluents, agricultural runoff, and hydrological alterations—have begun to disrupt this balance.

Climatically, the area experiences a **temperate Marmara climate**, with mild winters, warm summers, and moderate precipitation. This climate supports diverse vegetation zones and contributes to the productivity of both natural ecosystems and agricultural lands. The delta's proximity to major urban centers such as Bursa and Bandırma also places it within a zone of increasing socio-economic influence, intensifying land-use change and environmental stress.

Overall, the Kocasu River Delta represents one of Türkiye's most ecologically valuable yet vulnerable coastal wetland systems. Its geographic position, hydrological connectivity, and multi-layered landscape structure make it a critical site for sustainability assessment, conservation planning, and environmental monitoring.

3. ECOLOGICAL COMPONENTS

Longoz forests, sand dunes, lagoons, and marshes host:

- *Ciconia nigra* (Black Stork)
- *Pelecanus crispus* (Dalmatian Pelican)
- Endemic dune plants (sand lily, lake bulb)

These global delta images help illustrate what a **healthy delta system** should resemble.

The Kocasu River Delta hosts a multi-layered ecological system shaped by the interaction of fluvial, coastal, and wetland processes. Its ecological components form a dynamic mosaic that supports high biodiversity, regulates hydrological cycles, and provides essential ecosystem services to the wider Marmara region. These components include lagoon systems, flooded forests, marshlands, dune formations, riverine habitats, and agricultural interfaces—each contributing uniquely to the delta's ecological integrity.



Lagoon Ecosystems (Dalyan, Poyraz, Arapçiftliği) The delta's lagoon network represents one of its most critical ecological units. These semi-enclosed water bodies function as nutrient traps, fish nurseries, and migratory bird habitats. Their brackish water structure supports specialized flora and fauna, making them highly sensitive to hydrological changes and pollution inputs.

Flooded Forests (Longoz Ecosystems) The longoz forests surrounding the delta are among Türkiye's rarest wetland forest types. Characterized by alder, ash, and willow species, these forests regulate groundwater, stabilize soils, and provide refuge for amphibians, birds, and mammals. Seasonal flooding maintains their ecological rhythm, but industrial discharge and altered water flows threaten their resilience.

Marshes and Wetlands The marshlands act as natural filtration zones, removing sediments and contaminants from river inflow before they reach the Marmara Sea. They also serve as carbon sinks and buffer zones against storm surges. Their degradation directly reduces the delta's capacity to self-purify and maintain ecological balance.

Riverine and Alluvial Habitats the Kocasu River delivers sediment, nutrients, and freshwater essential for sustaining delta morphology and productivity. Its alluvial plains support diverse plant communities and serve as feeding grounds for birds and mammals. Any disruption in river discharge—whether from dams, industrial withdrawals, or pollution—immediately affects downstream ecological stability.

Coastal Dune Systems The dune formations along the shoreline protect inland ecosystems from coastal erosion and saltwater intrusion. These dunes host specialized vegetation adapted to harsh, shifting conditions. Human disturbance, sand extraction, and unregulated access have weakened dune stability in recent years.

Agricultural Interface Zones Surrounding farmlands form a transitional ecological zone where natural habitats meet intensive human land use. While agriculture contributes to local livelihoods, fertilizer runoff, pesticide drift, and irrigation withdrawals exert pressure on wetland ecosystems, altering nutrient cycles and accelerating eutrophication.

4. HOLISTIC SUSTAINABILITY FRAMEWORK

A holistic sustainability framework for the Kocasu River Delta requires integrating ecological, hydrological, socio-economic, and governance dimensions into a single analytical structure. Rather than evaluating environmental indicators in isolation, this approach emphasizes the interdependence of lagoon health, river discharge, land-use patterns, industrial activity, and community livelihoods. The framework combines field observations, satellite-based assessments, news-driven evidence, and long-term ecological data to capture both chronic pressures and emerging risks. It also incorporates resilience metrics—such as ecosystem stability, water quality trends, biodiversity response, and adaptive capacity—to evaluate how well the delta can withstand industrial contamination, hydrological alteration, and climate-driven stressors. By merging scientific data with real-time socio-environmental signals, the holistic sustainability framework provides a comprehensive basis for identifying vulnerabilities, prioritizing conservation actions, and guiding policy interventions that support long-term ecological integrity.

4.1. Biosphere Integrity

Recent news confirms:

- **Mass fish deaths** in Kocasu (2026)
- **Ecosystem collapse** due to industrial waste (2026)

4.2. Hydrosphere Pressures

Industrial pollution from Bursa reaches Kocasu and Çınarcık Dam:

- Industrial complex near river (2026)
- Muddy, contaminated shoreline (2026)

4.3. Atmospheric Deposition

Airborne pollutants from Bursa's industrial zone settle into the delta.

4.4. Lithosphere Degradation

Sand extraction and erosion continue to reshape the delta.



5. HUMAN-INDUCED PRESSURES (SUPPORTED BY 2026 NEWS)

Human-induced pressures on the Kocasu River Delta have intensified significantly in recent years, a trend clearly reflected in multiple 2026 news reports from Bursa and the wider Marmara region. Industrial discharge from nearby manufacturing zones, combined with agricultural runoffs rich in nitrates and phosphates, has accelerated eutrophication in lagoon systems such as Dalyan and Poyraz. Field observations from early 2026 documented episodes of water discoloration, fish mortality, and foul odors—symptoms consistent with chemical contamination and oxygen depletion. Local news outlets also reported unauthorized waste dumping near river channels, highlighting gaps in environmental enforcement and monitoring. Additionally, hydrological alterations linked to irrigation withdrawals and upstream industrial water use have reduced freshwater inflow, weakening the delta's natural self-purification capacity. Together, these human-driven pressures form a cumulative stress load that threatens the ecological stability, biodiversity, and long-term resilience of the Kocasu River Delta.

5.1. Industrial Pollution

News reports show:

- **Toxic discharges** into Kocasu River
- **Red-colored water** indicating chemical contamination
- **Fish kills** linked to industrial runoff

5.2. Agricultural Intensification

Flood irrigation and fertilizer runoff contribute to eutrophication.

5.3. Tourism Decline (Global Parallel)

Pollution-driven tourism collapse is documented in:

- Thailand's Kok River (2026)
- Rare earth mining pollution destroying river tourism (2026)

These cases mirror what could happen in Kocasu if degradation continues.

6. SUSTAINABLE MANAGEMENT STRATEGIES

Sustainable holistic management of the Kocasu River Delta requires an integrated approach that balances ecological protection, hydrological stability, and socio-economic needs. Effective strategies begin with restoring natural water flows, reducing industrial discharge, and implementing strict monitoring systems supported by real-time environmental data. Protecting lagoon ecosystems and longoz forests must be prioritized through habitat restoration, buffer-zone creation, and limits on agricultural runoff. At the governance level, coordinated action between local authorities, environmental agencies, and community stakeholders is essential to ensure compliance, transparency, and long-term stewardship. Sustainable management also involves adaptive planning—regularly updating policies based on new scientific findings, field observations, and emerging risks reported in regional news. By combining ecological resilience principles with participatory governance and evidence-based decision-making, the delta can transition toward a more stable, productive, and environmentally secure future.

6.1. Pollution Control

- Advanced wastewater treatment
- Continuous monitoring
- Heavy metal regulation

6.2. Forest Conservation

- Protection of longoz forests
- Anti-poaching enforcement

6.3. Sustainable Agriculture

- Drip irrigation
- Organic farming incentives

6.4. Community-Based Conservation

Local participation is essential.



6.5. Scientific Monitoring

Remote sensing and atmospheric modeling required.

Conclusion

The Kocasu River Delta is undergoing **rapid ecological decline**, confirmed by:

- 2026 fish deaths
- Industrial contamination
- Visible water discoloration
- Ecosystem collapse alerts

Holistic sustainability offers the only viable path forward.

7. DISCUSSION

The findings of this study reveal that the Kocasu River Delta is undergoing a rapid ecological transformation driven primarily by human-induced pressures. Recent environmental news from 2024–2026, including **mass fish deaths**, **industrial discharge alerts**, and **visible water discoloration**, confirms that the delta is experiencing hydrological and biological stress similar to other deltas worldwide. These events are not isolated; they reflect a broader pattern of wetland degradation documented by UNEP (2024) and IPBES (2023).

7.1. Hydrological Collapse and Pollution Dynamics

The hydrosphere of the delta shows clear signs of collapse. Industrial wastewater from Bursa's textile, automotive, leather, and food sectors continues to reach the delta via Nilüfer Stream. News reports from 2026 documented **red-colored water**, **chemical odor**, and **dead fish accumulating along the riverbanks**, indicating acute contamination episodes. Similar events have been observed in the Mekong Delta (Vietnam, 2025) and the Mississippi Delta (USA, 2024), where industrial runoff triggered eutrophication and biodiversity loss.

These parallels highlight that Kocasu is not an exception; it is part of a global pattern of delta degradation driven by industrial expansion and insufficient wastewater treatment.

7.2. Biodiversity Decline and Habitat Fragmentation

The delta's biodiversity—once a stronghold for migratory birds, endemic plants, amphibians, and endangered fish—is now under severe threat. Habitat fragmentation caused by agricultural expansion, illegal logging, and sand extraction has reduced the ecological connectivity essential for species survival. The decline of longoz forests, which serve as critical breeding and feeding grounds, mirrors the degradation of Europe's Danube Delta (2025), where forest loss accelerated bird population decline.

7.3. Atmospheric and Climate Pressures

Atmospheric deposition from Bursa's industrial zone contributes to soil acidification and water contamination. IPCC (2023) reports that climate change intensifies these pressures by altering precipitation patterns, increasing flood frequency, and reducing groundwater recharge. The Kocasu Delta's hydrological balance is particularly sensitive to these changes due to its shallow lagoons and narrow river mouth.

7.4. Socio-Economic Implications

The degradation of the delta has direct socio-economic consequences:

- Decline in local fisheries due to fish mortality
- Reduced agricultural productivity from contaminated irrigation water
- Loss of ecotourism potential
- Increased public health risks from polluted water

These impacts resemble the socio-economic collapse observed in India's Godavari Delta (2024), where pollution-driven fishery losses affected thousands of households.

8. CONCLUSION

The Kocasu River Delta stands at a critical ecological crossroads. Without immediate intervention, the region faces the risk of irreversible biodiversity loss, hydrological imbalance, and socio-economic decline. Yet, the findings of this assessment also reveal that a holistic sustainability approach—integrating ecological, hydrological, atmospheric, and socio-economic dimensions—offers a viable and scientifically grounded pathway for recovery. The delta's natural assets, including longoz forests, lagoon systems, sand dunes, and



diverse fauna, provide a strong foundation for ecological restoration, sustainable tourism, and community-based conservation. Global examples demonstrate that deltas can recover when strategic, well-coordinated interventions are implemented.

The recommended measures outlined in this report further confirm that the Kocasu River Delta retains both the ecological capacity and structural resilience required for long-term rehabilitation. Pollution control, forest and habitat conservation, sustainable agricultural practices, community stewardship, and advanced scientific monitoring collectively form a comprehensive sustainability framework capable of reversing current degradation trends. When applied in a coordinated and science-driven manner, these interventions will not only restore water quality, biodiversity, and habitat integrity but also strengthen socio-economic conditions by improving agricultural productivity, reducing public health risks, and expanding ecotourism opportunities.

However, the window for effective action is rapidly narrowing. News reports from 2026, combined with field observations and global delta comparisons, clearly indicate that human-induced pressures are intensifying faster than natural systems can adapt. This underscores the urgent need for strict policy enforcement, multi-stakeholder collaboration, and continuous environmental monitoring. The expected gains—such as clearer lagoon waters, healthier longoz forests, stabilized soils, and stronger community resilience—highlight that sustainability is not only achievable but also essential for safeguarding the delta's future.

With decisive, coordinated, and science-based action, the Kocasu River Delta can transition from a vulnerable ecosystem to a model of integrated, holistic, and forward-looking environmental management. The opportunity for recovery still exists, but it requires commitment, urgency, and sustained stewardship.

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