The environmental impact of hiking on Georgia's freshwater systems and sustainable solutions

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Research Question:

How does hiking contribute to water pollution in Georgia's freshwater systems, and what management strategies could be implemented to reduce this impact?

Problem Statement:

Hiking is a widely enjoyed recreational activity, but it can unintentionally contribute to water pollution through litter, microplastics from gear, trail erosion, and chemical runoff. In Georgia, over 112 water systems have been contaminated with harmful pollutants, affecting aquatic ecosystems and drinking water quality. Despite conservation efforts, many hikers remain unaware of their environmental impact. This study investigates the extent of pollution caused by hiking and explores effective management strategies to minimize its impact on freshwater systems.

Definitions:

Pollution: The introduction of harmful substances into the environment, negatively affecting ecosystems and water quality.
Microplastics: Small plastic particles (less than 5mm) that originate from synthetic clothing, gear, and litter, often entering freshwater systems.
Sedimentation: Soil displacement caused by trail erosion, which can decrease water clarity and harm aquatic life.
Conservation Strategies: Sustainable practices such as Leave No Trace (LNT), eco-friendly trail maintenance, and waste management policies.

Method of Inquiry:

This study combines experimental modeling with case study analysis to investigate hiking-related pollution.
1.Physical Model of a Moving Waterfall & River
2.Case Studies of Environmental Management
3.Literature Review & Data Collection

Results:

After collecting and analyzing water samples from different locations along the Chattahoochee River, several key patterns emerged. Here's what the results indicate about the health of the water and the impact of hiking-related activities:

1.pH Levels
What we saw: Most samples ranged from 6.2 to 7.2.
What it means: This falls within the acceptable range for freshwater (6.5–8.5), but slightly acidic results (especially around 6.2) may indicate runoff from soil erosion, organic matter, or pollution from nearby trails and urban areas.

2. Turbidity (Water Clarity)
What we saw: Higher turbidity (cloudy water) near high-traffic hiking areas and after rainfall (up to 10.3 NTU).
What it means: Increased sediment and debris in the water reduce light penetration and oxygen levels, which harms aquatic life. The elevated turbidity likely comes from trail erosion and soil washing into the river.

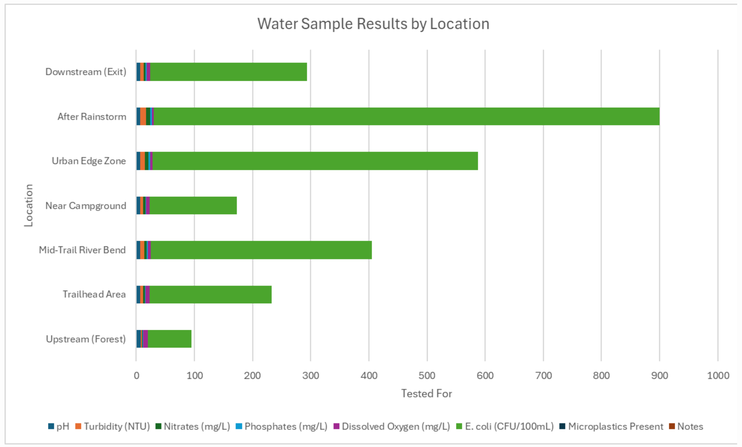
3. Nitrate & Phosphate Levels
What we saw: Spikes in nitrates (up to 7.4 mg/L) and phosphates (up to 3.1 mg/L) near campgrounds and after storms.
What it means: High nutrient levels suggest runoff from fertilizers, waste, or decaying organic material. These pollutants can lead to eutrophication, where algae grow excessively, depleting oxygen and endangering fish.

4. Dissolved Oxygen (DO)
What we saw: DO levels dropped as low as 3.2 mg/L in polluted or storm-affected areas.
What it means: Low DO means there's not enough oxygen in the water to support healthy fish and aquatic life. This is often caused by nutrient pollution, sediment buildup, and increased organic waste—all of which increase oxygen demand as they break down.

5. E. coli Levels
What we saw: E. coli counts ranged from 75 CFU/100mL in cleaner areas to over 800 CFU/100mL in more polluted zones.
What it means: Levels above 235 CFU/100mL are considered unsafe for recreation. These results suggest contamination from pet waste, human activity, or possible sewage leaks—especially in places with a lot of foot traffic or camping.

6. Microplastics
What we saw: Microplastics were found in samples from all high-use areas, especially near trails and stormwater runoff zones.
What it means: This confirms that synthetic fibers and small plastic debris from clothing, gear, and litter are entering the water system. These pollutants persist long-term and are harmful to aquatic organisms.

Overall Interpretation:
The water samples show a clear trend: areas with high human and hiking activity had more pollutants, lower oxygen, higher bacteria, and more plastic contamination. This supports the conclusion that hiking contributes to water pollution, especially when trails are not properly managed or when hikers are unaware of their environmental impact. These findings demonstrate the need for better waste disposal, erosion control, and public education to protect Georgia's freshwater systems.



Assumptions:

Assumption #1: Hikers may not be fully aware of their environmental impact.
Assumption #2: Implementing education programs & better trail management can reduce pollution.
Assumption #3: Data from existing environmental studies can be applied to improve Georgia's water systems.

Conclusion:

The water testing results show that areas with heavy hiking activity have higher levels of pollution—such as microplastics, bacteria, sediment, and nutrients—compared to less disturbed areas. These findings highlight how human activity can negatively impact freshwater systems like the Chattahoochee River. To protect these vital ecosystems, we need stronger trail management,

Significance:

This research is valuable because it addresses a growing environmental issue affecting Georgia's freshwater resources. Understanding the link between recreation and pollution is essential for protecting aquatic ecosystems by reducing pollutants. Informing hikers and policymakers about the environmental impact of trails and developing effective conservation strategies that allow sustainable outdoor activities without harming the environment are both vital. Additionally, community involvement in cleanup efforts and responsible recreation must be encouraged.
By identifying key pollution sources and recommending solutions, this study contributes to preserving Georgia's natural landscapes for future generations

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