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From one-time cleanup to long-term governance: a field investigation of tourism waste at Muztagh Ata

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Abstract. Mountain tourism allows visitors to experience landscapes that are distant from cities, yet the waste left around these landscapes may remain long after the visitors leave. This investigation examines a youth trash sweep conducted near Muztagh Ata in the beginning of August, 2026. It combines direct observation of the waste, its location, and the surrounding land use with academic studies and official waste-management guidance. Moreover, most visible items were consumer waste, especially beverage bottles and food packaging, while a smaller but noticeable group consisted of construction-related materials connected to a hotel being prepared nearby. Much of the waste was found away from the road and trapped in wet, muddy grass closer to the mountain. Its distribution suggests that wind had moved at least part of the lighter waste from the road and visitor stopping area, although the original source of each item could not be confirmed. The evidence indicates that travelers and passing visitors were probably the largest source, while nearby construction also contributed part of the waste. The trash sweep improved the site immediately, but it did not prevent new litter from entering the same area. Long-term improvement therefore depends on source reduction, clearer visitor responsibility, regular collection, and cooperation among scenic-area managers, construction operators, local communities, and volunteers.

Keywords: Muztagh Ata, tourism waste, windblown litter, trash sweep, environmental governance

1. Introduction

Muztagh Ata is known for the large mountain landscape surrounding it, and this beauty is also the main reason that many travelers stop nearby, walk toward the mountain, and take photographs. During the field visit in Early August, 2026, the mountain and the grassland created a sharp visual contrast with the trash found across the ground. From a distance, the area still looked open and clean because the mountain was much larger than every bottle or food package. However, once the trash sweep began, waste appeared between long grass, inside wet mud, and farther from the road than expected. This made the problem easy to overlook without entering the area directly. The beauty still remained, but it worked almost like a cover: it attracted attention toward the mountain while small pieces of pollution remained hidden below.

Mountain waste is not limited to one location. The United Nations Environment Programme reported that, in a survey of 1,750 mountain visitors from 74 countries, 99.7% had observed litter during a typical mountain trip. Plastics, food-related waste, paper, and cardboard were frequently seen near trails, parking areas, and

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resting places [1]. UNEP also explains that mountain waste may be moved by wind, rain, and melting water, allowing material left in one place to travel into rivers or other downstream environments [1]. These findings do not prove where the Muztagh Ata waste came from, but they help explain why trash discovered far from a road may not have been dropped exactly where it was found.

The field site was located near a road, with the mountain and long grass on one side and a small, less-developed village on the other side. A hotel was also being prepared or constructed nearby. The trash collected during the sweep mainly included beverage bottles and food packaging, including recognizable Coca-Cola bottles, while part of the material appeared related to architectural engineering and construction. Much of the waste was located toward the mountain rather than directly beside the road. Some pieces had become stuck inside wet soil and dense grass, suggesting that they had remained there through wind or water movement instead of being recently placed on a clean surface. The observed mixture immediately raised a more difficult question: whether the waste came mainly from tourists and people passing along the road, from the nearby village, from hotel construction, or from several sources at the same time.

This report uses participant observation as its main local evidence. The materials, their approximate categories, their position relative to the road, mountain, village, and hotel construction, and the condition of the grass and soil were recorded through the experience of joining the trash sweep. The investigation did not include laboratory testing, a complete item count, interviews with every nearby group, or a method that could trace each object back to the person who discarded it. As a result, the report separates observation from inference. It is an observation that bottles, food packaging, and construction-related material were present. It is also an observation that much of the waste was found in grass away from the road. In contrast, the claim that most consumer waste came from travelers and was blown toward the mountain is an inference based on location, material type, and the tourist use of the landscape. This inference is reasonable, but it is not treated as a proven fact.

Although the trash sweep removed visible waste and made the environmental problem easier to understand, it only addressed the final stage of a much longer process. The waste had already been produced, used, discarded, moved across the landscape, and trapped in grass before volunteers collected it. Therefore, the central argument of this investigation is that travelers and other road users were probably responsible for most of the bottles and food packaging, while nearby hotel construction contributed a smaller but still important share of engineering-related waste; wind and wet grass then changed the final distribution of the trash. The sweep improved the site for a short period, but long-term governance requires prevention, regular collection, clearer responsibility, and continued monitoring rather than depending only on volunteers to repeatedly remove the same problem.

2. Results

2.1. What the trash revealed about its possible sources

The trash discovered during the sweep did not form one completely uniform category. Instead, it consisted of two main groups that pointed toward different possible sources. The first and larger visible group was consumer waste, especially plastic beverage bottles and food packaging. Coca-Cola bottles were among the recognizable items, which showed that at least part of the waste was related to drinks and food consumed by individuals rather than only to industrial activity. The second group included architectural or engineering-based materials. Because a hotel was being prepared nearby, this material was reasonably connected to local construction activity, although the field observation could not identify the exact worker, company, date, or process responsible for every piece.

The consumer waste appeared to make up around half or more than half of the observed trash, while construction-related material appeared to form around half or less than half. This proportion must remain an approximate field judgment because the activity did not use a scale, fixed sorting categories, or a complete item count. It would therefore be inaccurate to report a precise percentage such as 70% tourist waste and 30% construction waste. However, the repeated appearance of bottles and food packages across the site makes it reasonable to state that consumer waste was at least one of the dominant visible categories. Research from other mountain destinations shows a similar importance of visitor-related packaging. Religa and Adach found that plastic represented a major part of waste collected from tourist trails in Tatra National Park and that much of the total waste was recyclable but persistent [2]. Their numerical results cannot be transferred to Muztagh Ata, yet their study supports the broader point that beverage and food packaging are common waste problems in heavily visited mountain landscapes.

The location of the waste was as important as its composition. Much of it was not resting directly beside the road. Instead, it appeared farther toward the mountain, where long grass, water, and mud made collection more difficult. If tourists had walked into the grass and dropped every item exactly where it was found, the distribution would represent direct on-site littering. However, the road created another possible route. Travelers, drivers, passengers, or visitors stopping for photographs may have discarded items near vehicles or the roadside, after which strong local wind moved lighter bottles and packaging toward the mountain. The trash then became trapped by wet grass or partly pressed into mud. Research on street-litter monitoring has specifically examined whether taller grass is associated with greater litter accumulation because vegetation can trap windblown materials [3]. UNEP also identifies wind and water as important ways mountain waste moves away from its original location [1].

As a result, the final location of an object should not be confused with its original point of disposal. A bottle inside wet grass may have been thrown there directly, blown from the road, or even moved through several smaller steps. The field pattern supports wind transport because the trash was concentrated away from the road in vegetation capable of stopping moving material. Nevertheless, this remains a geographic inference rather than direct proof. No individual item was followed from the road into the grass, and wind speed was not measured during the period when the trash arrived. The careful conclusion is therefore that wind probably transported at least part of the lighter consumer waste and helped concentrate it in the long grass.

The surrounding landscape also provides evidence about possible human sources. The mountain view was highly attractive, making the area a logical place for travelers to stop and take photographs. People passing along the road may have eaten food or consumed drinks during the journey, while some visitors may have remained briefly rather than entering a managed scenic facility. This type of short stop can create a responsibility gap: visitors enjoy the landscape, but because they do not remain long, the packaging they leave may become someone else's problem. A study of hikers in Wuyishan National Park found that awareness of consequences, personal responsibility, environmental knowledge, and personal norms were related to litter-management intentions [4]. This suggests that visitor behavior is influenced not only by whether a person likes nature, but also by whether that person recognizes a direct responsibility toward the place.

The small village across the road creates another possible source, but the available evidence does not justify blaming local residents. Some village-generated waste may have entered the area, especially because the village was nearby and appeared less developed. However, physical closeness alone does not show who discarded a particular bottle. The product types, the importance of the location as a scenic stopping point, and the road connection make travelers and passing road users a stronger explanation for a large share of the consumer waste. Meanwhile, construction materials form a separate line of evidence pointing toward the hotel

project. The most balanced interpretation is therefore not that one group created all pollution, but that several human activities produced different waste streams that later became mixed in the same grassland.

This mixed composition matters because each source requires a different solution. A sign asking tourists not to litter may reduce some bottles and food packaging, but it will not control loose construction material. Stronger construction-site storage and removal may reduce engineering waste, but it will not change what passing drivers throw from vehicles. The trash sweep placed every item into the same collection process, yet long-term governance must separate the problem again by source. Otherwise, the area may be cleaned without understanding why the trash appeared, allowing the same mixture to return.

2.2. The immediate value and limits of the trash sweep

The trash sweep created an immediate improvement because waste that had been hidden in grass and mud was physically removed from the landscape. This result should not be dismissed. Bottles and packaging that remained in the field could continue to break apart, move farther through wind or water, or remain visible to future visitors. Moreover, directly collecting waste allowed the participants to see environmental pollution as a material problem instead of only hearing general statements about Sustainable Development Goal 15. The activity changed the scale of observation: the mountain was no longer only a beautiful background, because the small objects below it became part of the same environment.

However, the sweep mainly addressed accumulated waste, not the continuing process that produced it. The U.S. Environmental Protection Agency places source reduction and reuse above recycling, treatment, and disposal in its waste-management hierarchy [5]. The reason is simple: preventing a bottle or package from becoming waste is more effective than repeatedly collecting it after it has entered the environment. In Muztagh Ata, the volunteers entered the process close to its final stage. The products had already been purchased, used, discarded, blown or moved, and trapped. Collecting them repaired part of the visible result, but it did not change the earlier decisions.

This difference can be understood through a comparison between a leaking pipe and the water already on the floor. The trash sweep removed some of the water from the floor, which was necessary, but the pipe remained open. If travelers continued throwing packages, if construction materials were not secured, or if regular collection remained unavailable, new trash could enter the grass after the activity ended. As a result, a clean site immediately after the sweep cannot prove that the area's condition improved permanently. It only shows that the volunteers removed waste during one period.

The movement of trash made this limitation even more important. Because wind could transport waste away from the road, cleaning only the most visible roadside area would miss material already trapped farther inside the landscape. Meanwhile, collecting waste near the mountain would not reveal the exact location where it was first discarded. The final distribution was therefore created by both human behavior and natural movement. Long grass acted almost like a net: it stopped bottles and packaging after they moved, while mud and water made them harder to see and remove. Consequently, management based only on where trash is found may place facilities too late in the pathway. Prevention must also target where travelers stop, eat, drink, park, and leave the road.

The field activity also had clear measurement limits. No complete record was made of the number, weight, or volume of each category, and the route was not divided into fixed sections for comparison. Therefore, the report cannot objectively calculate how much waste came from tourism, construction, or the village. It also cannot compare the amount with another month or determine whether litter was increasing. Participatory monitoring research in the Dolomites demonstrates that mapped observations can turn public cleanup activity into data about contamination patterns [6]. A future activity near Muztagh Ata could use a simple version of

this method by recording the location, material category, count, photograph, and final disposal route for each section.

Another limitation concerns what happened after the bags were filled. Removing waste from grass is only one part of management; the waste must also be transported, sorted when possible, and delivered to an appropriate treatment or disposal system. If the destination was not documented, the report should not claim that the material was recycled. This missing stage is important because the visual ending of a cleanup often shows volunteers holding full bags, making the activity feel complete. In reality, the bags mark the middle of the management chain rather than its end.

Despite these limits, the sweep had educational and communication value. The participants saw that a scenic environment can look clean from the road while holding waste inside grass only a short distance away. This observation is more specific than a slogan such as "protect the environment". It shows how consumer behavior, road travel, wind, vegetation, water, and construction activity may combine into one local issue. Yet educational value should not be exaggerated into a claim that every participant developed permanent environmental habits. No long-term follow-up survey was conducted. The strongest conclusion is that the activity created direct awareness and evidence, while whether that awareness changed future behavior remains unknown.

2.3. From repeated cleaning to long-term responsibility

Long-term improvement near Muztagh Ata first requires different responsibilities for different sources of waste. Travelers and passing road users control whether bottles and food packages are carried away or discarded. Scenic-area managers and public authorities control signs, collection points, maintenance schedules, and enforcement. Hotel developers and construction operators control building materials and construction-site waste. Local residents have long-term knowledge of the area but should not be treated as automatically responsible for waste created by outside visitors. Finally, youth volunteers can support collection, observation, and communication, but they cannot replace every formal responsibility.

For travelers, the most direct solution is to prevent consumer waste from entering the landscape. Xinjiang's revised household-waste regulations state that self-driving tourists should place waste in collection containers at campsites, roads, scenic areas, and other public locations, while throwing or leaving household waste is prohibited [7]. In addition, a 2023 civilized-tourism campaign supported by China's Ministry of Culture and Tourism promoted the idea that travelers should take away their own trash along the Duku Highway in Xinjiang [8]. These policies show that visitor responsibility is already recognized. However, a rule becomes more effective when the expected action is convenient and clear.

Signs near common photography and stopping areas should therefore provide specific instructions rather than only general environmental language. A statement such as "Protect the beautiful mountain" expresses a positive value, but it may not tell a traveler what to do when no container is visible. A stronger message could tell visitors to keep all bottles and food packages in their vehicles until the next collection point, explain that wind can carry light waste into wet grass, and identify the nearest legal disposal location. This would connect the visitor's small decision to the larger landscape instead of treating litter as an unrelated moral failure.

Management infrastructure must support the same goal. Collection points should be placed near the locations where vehicles stop and people consume food, not only where trash is finally trapped. They also require regular removal; otherwise, an overflowing container can become another source of windblown waste. Research in Tatra National Park found that the frequency and regularity of waste removal were important parts of an effective trail-management strategy [2]. The exact number and placement of containers required near Muztagh Ata cannot be determined from one field visit, but the observed distance between the road and

trapped waste suggests that management should examine both roadside stopping behavior and downwind accumulation areas.

Construction-related material requires a separate response. Because a hotel was being prepared nearby, construction managers should prevent light materials from leaving the work area, maintain designated storage, and arrange removal through a verified service. This responsibility should not be merged into tourist education. If a piece of insulation, packaging, plastic sheet, or other engineering material enters the grass, telling travelers to carry their bottles away will not solve it. Furthermore, construction activity connected to tourism should not damage the same landscape that gives the hotel its future economic value. A hotel built to serve mountain visitors has a direct reason to protect the view and environment that attract those visitors.

The village across the road should be included through observation and communication rather than assumption. Residents may know which locations repeatedly collect waste, how strong winds move through the area, when tourist traffic is highest, and whether collection service changes across seasons. At the same time, outside tourism and construction may create waste beyond the village's capacity or responsibility. International guidance on sustainable tourism emphasizes planning that includes managers and other local stakeholders [9]. Therefore, community participation should provide residents with a voice and useful resources instead of transferring the cost of tourism pollution onto them.

Youth cleanups can become more effective when they are repeated with a simple investigation method. Before a future sweep, organizers could divide the site into road, photography-stop, grassland, wet-ground, village-facing, and construction-facing sections. During collection, teams could separate consumer packaging from construction-related material, count or weigh each category, record coordinates or landmarks, and photograph the condition before and after. Afterward, the information could be shared with the responsible manager or organization. This process would transform a one-day cleanup from an isolated service event into the beginning of a local evidence record.

The documentary produced during the summer program can also help, but only if it shows the full problem honestly. It should not end by suggesting that several bags solved the waste issue. Instead, it can show the mountain's beauty, the hidden trash inside wet grass, the mixture of consumer and construction materials, and the uncertainty over the exact source of each item. The strongest story is not that young volunteers rescued an entire mountain. It is that entering the landscape revealed a system that could not be seen from the road, and that cleaning the final result led to questions about who produces, moves, collects, and prevents waste.

Ultimately, long-term governance depends on connecting these responsibilities. Travelers must control personal waste; construction operators must secure and remove building material; managers must provide and maintain collection systems; authorities must enforce existing rules; local residents must be included in long-term observation; and volunteers can contribute labor and evidence. If one part is missing, trash can pass through the gap and return to the grass. Cooperation does not mean that everyone carries the same responsibility. It means that each group performs the part that matches its authority, resources, and connection to the site.

3. Conclusion

The Muztagh Ata trash sweep revealed an environmental problem that was easy to miss when viewing the mountain only from the road. Most visible waste consisted of bottles and food packaging, including Coca-Cola bottles, while a smaller but noticeable part consisted of construction or engineering-related material associated with a nearby hotel project. Much of the trash was found farther toward the mountain, where wet mud and long grass had trapped it. These observations suggest that travelers and passing road users were probably the

largest source of consumer waste, while hotel construction contributed part of the remaining material. Wind most likely moved at least some lighter waste away from the road, although the original source and path of each object could not be proven.

The investigation therefore avoids making the simple claim that tourists directly threw every item where it was collected. The village, construction site, road traffic, visitors, and wind all formed possible parts of the system. Nevertheless, the material composition and the scenic function of the location make travelers a stronger explanation for much of the bottle and food waste than the nearby village alone. Meanwhile, the engineering materials provide separate evidence of construction influence. Rather than choosing one source for all waste, the report concludes that several waste streams became mixed after entering the same landscape.

The sweep produced a real but temporary improvement. It removed visible and partly hidden waste, allowed participants to observe how trash collects in wet grass, and created material for environmental communication. However, the activity did not stop new bottles from being discarded, secure construction materials, establish regular collection, or measure long-term changes. Like removing water while a pipe continues leaking, the sweep addressed the result without closing every source. This does not make the activity meaningless; it shows where its value begins and where its limits appear.

Long-term improvement requires prevention before repeated removal. Travelers should carry personal waste to serviced collection points, while managers should place and maintain facilities near stopping and photography areas. Construction operators should contain and remove building materials separately. Local residents should be included because they have longer experience with the site, while public authorities should maintain clear responsibility and enforcement. Youth volunteers can continue to clean, map, record, and communicate, but they should support routine governance rather than replace it.

This investigation remains limited because it was based on one short field activity without a complete item count, weight record, wind measurement, or source interview. Future studies should repeat the same route, separate waste into fixed categories, map where each item is found, record the condition of nearby facilities, and follow the collected material to its final destination. Such evidence could test whether the present inference about travelers, construction, and wind remains consistent over time. The most important lesson from this case is not that one trash sweep permanently protected Muztagh Ata. Instead, it demonstrates that a beautiful landscape may hide a complicated waste pathway, and that meaningful environmental action begins when cleaning is followed by evidence, responsibility, and prevention.

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