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COMMUNITY PERCEPTION AND ENVIRONMENTAL BEHAVIORAL PATTERNS IN THE UPPER CITARUM WATERSHED: A MULTI-ELEMENT ASSESSMENT FOR SUSTAINABLE REHABILITATION POLICY

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Abstract

The Upper Citarum River Basin in Kertasari District, Bandung Regency, West Java, has been the target of rehabilitation programs since 2000; however, domestic, agricultural, and livestock pollution persists. Previous programs have emphasized physical infrastructure rather than behavioral and institutional change and have lacked community-level baseline data. This mixed-methods study presents a social and environmental behavior assessment in Cihawuk, Cibeureum, Tarumajaya, and Cikembang villages as a basis for further rehabilitation planning. A 41-item questionnaire was administered to 240 students, while interviews, focus group discussions, and observations involved six community groups. Quantitative data were analyzed using descriptive statistics, Shapiro–Wilk, Kruskal–Wallis, and Mann–Whitney tests, while qualitative data were analyzed using domain analysis and document analysis. Results showed relatively similar behavioral profiles: only 38.9–40.4% of students agreed with environmentally oriented statements, whereas 59.6–61.1% disagreed, with no significant differences between areas ($p = 0.992$). Qualitative findings highlighted inadequate waste and livestock management facilities, weak integration of environmental education, low trust in government, and unsustainable past programs. Upper Citarum pollution is therefore a cross-regional structural issue, requiring coordinated, evidence-based, behavior-oriented policies integrating educational, cultural, social, economic, and institutional interventions.

Keywords: Citarum watershed; pro-environmental behaviour; community perception; Mental Revolution; watershed rehabilitation policy

INTRODUCTION

1.1 Background

The Citarum River is the longest and largest river in West Java and the third longest in Java after the Bengawan Solo and Brantas rivers, stretching approximately 300 km from its source on the slopes of Mount Wayang in Tarumajaya Village, Kertasari Subdistrict, Bandung Regency, to its estuary in Karawang. The river holds substantial historical, economic, and social value, supplying water, hydroelectric power, food, and livelihoods to millions of people across West Java and Jakarta for generations.

Despite its importance, decades of urbanisation, unsustainable agriculture, untreated industrial and domestic waste discharge, environmentally damaging aquaculture, rapid large-scale infrastructure development, and entrenched cultural practices have severely degraded the watershed. In 2013 the Citarum was named among the world's most polluted rivers by the Blacksmith Institute and Green Cross (2013), based on the severity of contamination found in West Java's longest waterway. Clinical testing by the Bandung Food and Drug Monitoring Agency subsequently detected hazardous substances—including mercury, coliform bacteria, iron, manganese, lead, sulphur, and chlorine—in the river's water and fish, despite the river supplying water to roughly 27.5 million residents of West Java and Jakarta, including an estimated 80% of Jakarta's drinking water (Blacksmith Institute & Green Cross, 2013).

The West Java Provincial Environmental Agency reported that approximately 90% of the 3,236 textile industries along the Citarum lacked adequate wastewater treatment installations, discharging effluent directly into the river (Dinas Lingkungan Hidup Provinsi Jawa Barat, 2018). Laboratory testing also identified dangerous bacteria, including Escherichia coli from human and livestock waste and Pseudomonas aeruginosa—typically associated with hospital environments—suspected to originate from improperly disposed medical waste (Dinas Lingkungan Hidup Provinsi Jawa Barat, 2018). Upstream erosion compounds the problem: in 2015, erosion within the Citarum's critical

land areas reached an estimated 6.1 million tonnes per year, associated with 79,549 hectares of critical land (38,963 ha within forest areas and 40,585 ha outside forest areas) (Kementerian Lingkungan Hidup dan Kehutanan [KLHK], 2020). Reforestation efforts by the Ministry of Environment and Forestry (KLHK) since 2015, covering 18,925 hectares, are reported to have reduced this figure to approximately 5.2 million tonnes per year, though the watershed remains severely degraded (KLHK, 2020).



Figure 1. The Situation in the Citarum Area

1.2 Past Interventions and the Policy Gap

Multiple provincial and national programmes have targeted Citarum's rehabilitation. The 2000–2003 Citarum Bergetar ("Clean, Beautiful, and Sustainable") programme focused on conservation recovery and community empowerment. In 2008, a Rp 6.7 trillion loan from the Asian Development Bank financed the Integrated Citarum Water Resources Management Investment Program (ICWRMIP), envisaged to run until 2023 but discontinued in 2011. In 2013 the provincial government launched Citarum Bestari ("Clean, Healthy, Beautiful, and Sustainable") and established the Citarum Watershed Forum, with an (unmet) target of restoring the river to potable quality by 2018. Most recently, Presidential Regulation No. 15 of 2018 established Citarum Harum, a seven-year, cross-institutional programme coordinated by the Coordinating Ministry for Maritime Affairs and involving the West Java provincial government, the Siliwangi Military Command, and the West Java Regional Police, aimed at integrating previously fragmented institutional efforts (Peraturan Presiden Republik Indonesia Nomor 15 Tahun 2018). Subsequent evaluations of the programme's downstream pollution-load performance and its multi-stakeholder governance model have been published (Permatasari, 2022; Abdillah, Widianingsih, Buchari, & Nurasa, 2024), alongside field-based sedimentation assessments in the upper watershed (Kurniawan, Setyarini, Kushartomo, Tajudin, & Sandjaya, 2019) and analyses of pollution-load allocation along the river (Djuwita, Hartono, Mursidik, & Soesilo, 2021).

A consistent pattern emerges across these programmes: an emphasis on physical infrastructure over human-capacity development, discontinuity between administrations, minimal monitoring and evaluation, and limited, poorly coordinated community involvement. This pattern suggests that technical and infrastructural investment alone is insufficient without a parallel, evidence-based transformation of community environmental behaviour and institutional trust—what recent Indonesian development discourse has termed a "Mental Revolution" (Revolusi Mental). However, systematic empirical baselines documenting community environmental perception and behaviour at the village level, disaggregated by stakeholder group, have been largely absent from prior programme design, including from earlier national planning studies (e.g., Bappenas, 2018), which have been criticised for methodological opacity and limited follow-through.

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Figure 2. The Environmental Condition In Citarum

1.3 Research Objectives and Contribution

This study addresses this gap by presenting a baseline, multi-element social and environmental-behaviour assessment of four upstream villages in Kertasari Subdistrict—the immediate source area of the Citarum River. Specifically, the study aims to: (1) map community perceptions of environmental pollution and prior conservation/rehabilitation programmes across six elements of society; (2) quantitatively characterise environmental-care behavioural tendencies among students as a proxy for the next generation's environmental disposition; (3) statistically test whether environmental-care behaviour differs significantly among the four villages; and (4) synthesise stakeholder-specific challenges and community aspirations into policy-relevant recommendations for future rehabilitation planning.

The contribution of this study is threefold. First, it combines a structured quantitative student survey (n = 240) with qualitative interviews across six distinct community elements, offering a more holistic diagnostic than either approach alone. Second, it applies formal inferential statistics (Shapiro-Wilk, Kruskal-Wallis, Mann-Whitney) to test—rather than assume—spatial homogeneity of environmental behaviour across villages, a question with direct implications for whether rehabilitation policy should be uniform or village-specific. Third, it links empirical findings explicitly to the design of a behaviour-centred policy framework across education, culture, social, and economic domains, intended to inform the ongoing Citarum Harum programme and future KLHK watershed rehabilitation planning.

LITERATURE REVIEW

Watershed degradation of the scale observed in the upper Citarum is well documented internationally as a product of interacting physical and social drivers (Abdillah et al., 2024). The Blacksmith Institute and Green Cross's (2013) assessment of the world's most polluted places identified the Citarum among ten global sites where industrial and domestic contamination posed severe public-health risk, underscoring that river pollution of this magnitude typically reflects institutional as much as technical failure. More recent watershed-management scholarship has continued to document the scale of the problem, from downstream pollution-load assessments (Permatasari, 2022) to collaborative multi-stakeholder governance analyses (Abdillah et al., 2024; Hadfield et al., 2024).

A substantial body of environmental-psychology literature addresses why pro-environmental attitudes do not reliably translate into pro-environmental behaviour (Stern, 2000). Kollmuss and Agyeman's (2002) synthesis of the determinants of pro-environmental behaviour identifies internal factors (motivation, knowledge, values, locus of control) and external factors (infrastructure availability, economic constraints, social and cultural context) as jointly shaping the well-documented "attitude–behaviour gap." Ajzen's (1991) Theory of Planned Behaviour similarly frames behaviour as a function of attitude, subjective norm, and perceived behavioural control—the latter particularly relevant where, as in Kertasari, waste-disposal infrastructure is scarce, making "proper" disposal behaviourally difficult even when attitudinally endorsed. Place-based environmental attachment has likewise been shown to shape responsible behaviour (Vaske & Kobrin, 2001), while social-learning accounts emphasise that children's environmental habits are substantially acquired through observation and imitation of peers and authority figures (Bandura, 1977)—a mechanism directly relevant to the peer-imitation items included in this study's questionnaire. Comparable attitude–behaviour patterns around river sanitation have been documented elsewhere in rural Indonesia, where open-defecation practices persist despite normative disapproval when infrastructure and social norms remain weak (Odagiri et al., 2017).

Hofstede's (1980) cultural-dimensions framework characterises Indonesian society as strongly collectivist, with pronounced deference to authority figures (teachers, parents, religious and government leaders), a pattern consistent with earlier ethnographic accounts of Javanese religious and social authority (Geertz, 1960). This has direct relevance for environmental-education strategy: knowledge transmitted to children through schools may have limited capacity to influence household or community practice unless it is reinforced through, or channelled via, recognised authority figures—a dynamic explored qualitatively in this study through interviews with community and religious leaders. Empirical evidence on this point is mixed: some studies report that child-oriented environmental education can measurably raise parental knowledge and household behaviour (Damerell, Howe, & Milner-Gulland, 2013; Husin et al., 2025), while others find that such intergenerational transfer does not reliably translate into changed adult behaviour, particularly in strongly authority-oriented household structures.

Methodologically, the qualitative component of this study draws on Spradley's (1979) domain analysis, a widely used ethnographic technique for identifying cultural domains and their internal structure from field notes, interviews, and document review, and on Bowen's (2009) document-analysis approach, which treats secondary documents (government reports, NGO data, prior programme evaluations) as a systematic data source to be coded and interpreted alongside primary fieldwork. These techniques sit within a broader qualitative tradition of systematic thematic coding (Miles, Huberman, & Saldaña, 2014) and grounded, iterative category development (Corbin & Strauss, 2015; Denzin & Lincoln, 2018). Together, these approaches support triangulation between the quantitative behavioural survey and the qualitative institutional and cultural analysis presented below.



Figure 3. Interviews with community leaders.

METHOD

3.1 Research Design

This study employed a sequential explanatory mixed-methods design (Creswell & Plano Clark, 2018), comprising a descriptive-comparative quantitative survey among students, followed by qualitative interviews, focus group discussions (FGDs), field observation, and video documentation among six broader community elements. The quantitative component was intended to establish a measurable behavioural baseline and test for spatial (inter-village) variation, while the qualitative component was designed to explain the mechanisms, institutional context, and lived experience underlying the quantitative patterns.

3.2 Study Area

The study was conducted in four villages of Kertasari Subdistrict, Bandung Regency, West Java—Cihawuk, Cibeureum, Tarumajaya, and Cikembang—located in the immediate headwater area of the Citarum River on the slopes of Mount Wayang. These four villages were purposively selected as the source area most directly implicated in upstream sedimentation, erosion, and pollution loading. Table 1 summarises the population and Table 2 the dominant livelihood structure of Kertasari Subdistrict.

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Table 1. Population of Kertasari Subdistrict Villages

Village	Male	Female	Total
Cikembang	3,387	3,530	6,917
Cihawuk	3,172	2,946	6,118
Cibeureum	8,265	8,065	16,330
Tarumajaya	7,532	7,792	15,324
Sukapura	4,447	4,224	8,671
Santosa	2,790	2,761	5,551
Neglawangi	2,400	2,379	4,779
Resmitinggal	2,857	2,661	5,518
Total (8 villages)	34,850	34,358	69,208

Note: The four bolded/highlighted villages (Cikembang, Cihawuk, Cibeureum, Tarumajaya) constitute the focus of this study; the remaining four villages are shown for subdistrict-level context. Source: Bandung Regency Government (bandungkab.go.id).

Table 2. Dominant Livelihoods in Kertasari Subdistrict

Occupation	Percentage
Farmer (Petani)	16.65%
Trader (Pedagang)	5.14%
Livestock Farmer (Peternak)	6.22%
Entrepreneur/Craftsman	7.30%
Industrial Labourer	0.93%
Construction Labourer	0.33%
Plantation Labourer	13.08%
Farm Labourer (Buruh Tani)	45.20%
Civil Servant/Military/Police	1.25%
Retiree	3.90%

3.3 Population and Sampling

The quantitative respondents were students from elementary (SD), junior secondary (SMP), and senior secondary (SMA/MA/MTs) schools within each of the four villages. A quota sample of 60 students per village was drawn (total n = 240), stratified by school of origin to reflect the actual school-age population distribution within each village (Table 3). For the qualitative component, purposive sampling was used to identify key informants across six community elements: (1) educators (school principals and teachers), (2) students across educational levels (including kindergarten pupils, for whom FGDs were narrated by teachers), (3) community and religious leaders (neighbourhood/hamlet heads, sub-district heads, village elders, and religious figures), (4) youth and leaders of environmental groups, (5) livestock farmers, and (6) crop farmers.

Table 3. Distribution of Student Respondents by School of Origin and Village

Village	School	n	%
Cihawuk	SDN Cihawuk	30	50%
Cihawuk	SMP Darul Hasan	20	33%
Cihawuk	SMA Darul Hasan	10	17%
Cibeureum	SD Nurul Huda	4	7%
Cibeureum	SMP Nurul Huda	16	27%
Cibeureum	SD Karya Bakti	10	17%
Cibeureum	MTs Karya Bakti	20	33%
Cibeureum	MA Karya Bakti	10	17%
Tarumajaya	SDN Lembangsari	6	10%
Tarumajaya	MTs Lembangsari	44	73%
Tarumajaya	MA Lembangsari	10	17%
Cikembang	MTs Al Fattah	28	47%
Cikembang	MA Al Fattah	32	53%
Total		240	100%

3.4 Instruments

The quantitative instrument was a structured questionnaire comprising 41 statements on environmental-care character, rated on a four-point Likert scale (Strongly Disagree/STS, Disagree/TS, Agree/S, Strongly Agree/SS), covering domains of solid-waste disposal behaviour, riverine sanitation practice (bathing, washing, and defecation in the river), erosion and reforestation awareness, livestock-manure management, peer-imitation behaviour, and normalisation of pollutive practices. Items were framed both positively and negatively to reduce acquiescence bias, and each respondent's item-level mean was subsequently classified into one of four categories (Strongly Agree/Agree/Disagree/Strongly Disagree with pro-environmental orientation) for cross-village comparison. The qualitative instruments comprised semi-structured interview guides tailored to each of the six community elements, an FGD protocol, a structured field-observation checklist, and video documentation of interview and observation sessions.

3.5 Data Analysis

Quantitative data were first summarised descriptively (frequencies, percentages, item means) using the four-point Likert conversion scale (mean score 1.00–1.75 = Strongly Disagree; 1.76–2.50 = Disagree; 2.51–3.25 = Agree; 3.26–4.00 = Strongly Agree). Respondent-level mean environmental-care scores were then aggregated into a four-category distribution per village. Because each village sub-sample (n = 60) fell below the conventional n = 50 threshold for the Shapiro-Wilk test, normality was assessed using Shapiro-Wilk (Shapiro & Wilk, 1965) rather than Kolmogorov-Smirnov. Given non-normal distribution in at least one village group, the non-parametric Kruskal-Wallis H test (Kruskal & Wallis, 1952) was used to test for overall inter-village differences in environmental-care behaviour, followed by pairwise Mann-Whitney U post-hoc tests (Mann & Whitney, 1947) across all six village pairs. All quantitative tests used a significance threshold of $\alpha = 0.05$ and were conducted in SPSS (Field, 2013).

Qualitative data from interviews, FGDs, and field observation were transcribed and coded thematically using Spradley's (1979) domain analysis and standard thematic-coding procedures (Miles, Huberman, & Saldaña, 2014), supplemented by document analysis (Bowen, 2009) of secondary materials, including official government reports, national and international environmental-organisation data, and prior Bappenas (2018) programme documentation, to contextualise and triangulate primary findings.

3.6 Ethical Considerations

Participation was voluntary for all respondents and informants. Student participation was coordinated through participating schools with teacher facilitation, and responses were recorded anonymously at the individual level, with only school and village identifiers retained for aggregate analysis. Adult informants (educators, community leaders, farmers, livestock farmers, and youth) provided verbal consent prior to interviews, FGDs, and video documentation.

RESULTS AND DISCUSSION

4.1 Respondent Profile: Parental Occupation

Table 4 summarises the reported primary occupation of respondents' parents across the four villages. Farming (petani) was the single largest occupational category in every village, ranging from 47% in Cihawuk to 58% in Cibeureum, consistent with the subdistrict-level livelihood profile reported in Table 2. Entrepreneurship (wiraswasta) was notably more prevalent in Cikembang (30%) than in the other three villages (10–15%).

Table 4. Parental Occupation by Village (n = 60 per village)

Occupation	Cihawuk	Cibeureum	Tarumajaya	Cikembang
Casual labourer	8 (13%)	10 (17%)	13 (22%)	2 (3%)
Farm labourer	12 (20%)	7 (12%)	6 (10%)	9 (15%)
Housewife	2 (3%)	1 (2%)	2 (3%)	1 (2%)
Trader	4 (7%)	0 (0%)	0 (0%)	0 (0%)
Farmer	28 (47%)	35 (58%)	30 (50%)	30 (50%)
Entrepreneur	6 (10%)	7 (12%)	9 (15%)	18 (30%)
Total	60 (100%)	60 (100%)	60 (100%)	60 (100%)

4.2 Estimated Domestic and Livestock Waste Burden

Village-level estimates of daily domestic waste generation and cattle-manure output, compiled from population and livestock census figures collected during the assessment, are presented in Tables 5 and 6. Cibeureum—the most populous of the four villages and host to the largest cattle population—generates the highest

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estimated volumes of both domestic waste and livestock manure, indicating that infrastructure investment needs are not uniform across villages even where behavioural profiles are similar (see Section 4.4).

Table 5. Estimated Daily Domestic Waste Generation

Village	Population	Estimated Waste (kg/day)
Cihawuk	6,118	15,860
Cibeureum	16,330	43,125
Cikembang	6,917	16,935
Tarumajaya	15,324	37,660

Note: Figures on waste generation are as reported by the field assessment team; the stated per-capita assumption (0.5 kg/person/day) does not fully reconcile with the reported totals, suggesting the underlying estimate may incorporate non-residential or seasonal waste sources. Field verification is recommended before these figures are used for infrastructure sizing (see Section 6, Limitations).

Table 6. Estimated Daily Cattle-Manure Output

Village	Cattle (head)	Estimated Manure (kg/day)
Cihawuk	83	1,660
Cibeureum	881	17,620
Cikembang	218	4,360

Note: Comparable livestock-manure data were not available for Tarumajaya in the source dataset.

4.3 Descriptive Profile of Students' Environmental-Care Behaviour

Across all four villages, the 41-item environmental-care questionnaire showed a consistent internal pattern: items describing categorical rejection of visibly harmful practices (e.g., “littering is normal and harmless,” “defecating in the river is acceptable,” “I will litter wherever there is no bin”) received strong disagreement (mean scores 1.33–1.70, “Strongly Disagree”), and items expressing direct emotional or normative disapproval of littering (“I feel annoyed seeing littered classrooms,” “I get angry seeing a friend litter”) received strong agreement (mean scores 3.20–3.82, “Strongly Agree”) in every village. However, items describing behaviour under infrastructural constraint told a different story: the statement “when sweeping a dirty classroom floor, I will simply dispose of the dirt into the river” received “Agree”-level scores in all four villages (mean 2.80–3.20), and items regarding the acceptable timing of bathing/washing/toileting in the river, or discomfort with nearby livestock odour, clustered around the “Disagree” midpoint (mean 2.10–2.50) rather than strong rejection—indicating conditional tolerance where sanitation infrastructure is absent.

When each respondent's overall mean score was classified into the four-category scale and aggregated per village, the resulting distributions (Table 7, Figure 1) were remarkably similar across all four sites: pro-environmental agreement (“Agree” + “Strongly Agree”) ranged only from 38.87% (Tarumajaya) to 40.36% (Cikembang), while disagreement (“Disagree” + “Strongly Disagree”) ranged from 59.63% (Cikembang) to 61.14% (Tarumajaya).

Table 7. Distribution of Students' Aggregate Environmental-Care Category by Village

Village	Strongly Agree	Agree	Disagree	Strongly Disagree	Total
Cihawuk	13 (21.22%)	11 (17.76%)	17 (27.89%)	20 (33.13%)	60 (100%)
Cibeureum	11 (19.02%)	12 (20.04%)	18 (30.33%)	18 (30.61%)	60 (100%)
Tarumajaya	12 (19.72%)	11 (19.15%)	18 (30.45%)	18 (30.69%)	60 (100%)
Cikembang	14 (23.21%)	10 (17.15%)	16 (26.99%)	20 (32.64%)	60 (100%)

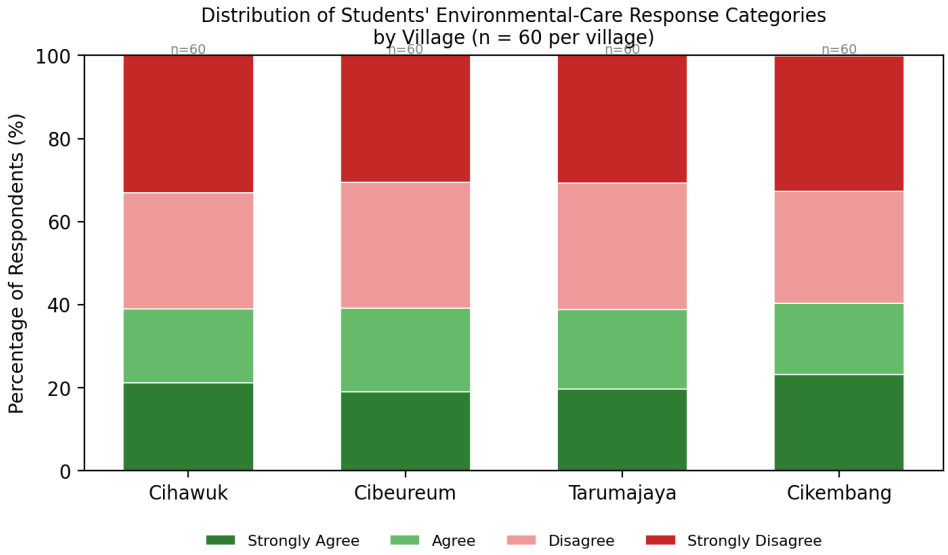


Figure 4. Distribution of environmental-care response categories by village (n = 60 per village).

4.4 Inferential Statistics: Cross-Village Comparison

The Shapiro-Wilk normality test (Table 8) indicated a non-normal distribution of environmental-care scores in Cibeureum (p = 0.017) and Tarumajaya (p = 0.035), while Cihawuk (p = 0.082) and Cikembang (p = 0.075) did not significantly depart from normality. Because at least one group violated the normality assumption, the non-parametric Kruskal-Wallis H test was used for the overall four-group comparison.

Table 8. Shapiro-Wilk Normality Test Results

Village	df	Sig. (p)	Distribution
Cihawuk	60	0.082	Normal
Cibeureum	60	0.017	Not normal
Tarumajaya	60	0.035	Not normal
Cikembang	60	0.075	Normal

The Kruskal-Wallis test produced Asymp. Sig. (p) = 0.992 (df = 3), which is far above the α = 0.05 threshold, indicating no statistically significant difference in environmental-care behaviour among the four villages. To confirm this at the pairwise level, six Mann-Whitney U post-hoc comparisons were conducted (Table 9); all six comparisons likewise returned non-significant results (all p > 0.05), confirming that the four villages form a behaviourally homogeneous group despite differing in population size, livestock density, and dominant occupational structure.

Table 9. Pairwise Mann-Whitney U Post-Hoc Comparisons

Village Pair	Asymp. Sig. (2-tailed)	Conclusion (α = 0.05)
Cihawuk vs. Cibeureum	0.992	No significant difference
Cihawuk vs. Tarumajaya	0.908	No significant difference
Cihawuk vs. Cikembang	0.760	No significant difference
Cibeureum vs. Tarumajaya	0.933	No significant difference
Cibeureum vs. Cikembang	0.838	No significant difference
Tarumajaya vs. Cikembang	0.817	No significant difference

4.5 Qualitative Findings by Community Element

Interviews, FGDs, and field observation with the six targeted community elements converged on a set of recurring, largely overlapping structural themes rather than village-specific idiosyncrasies, reinforcing the quantitative finding of cross-village homogeneity. Table 10 synthesises the principal issues raised by each stakeholder group.

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Table 10. Synthesis of Key Qualitative Findings by Community Element

Community Element	Principal Issues Identified
Educators (principals, teachers)	Low village-official education levels affecting public-service quality; low parental valuation of formal education (school seen as a pre-marriage waiting period); environmental content largely absent from local-content curriculum; budget constraints limiting school-based environmental programmes; two faith-based foundations (Al-Fattah in Cikembang; Karya Bakti in Cibeureum) have voluntarily integrated tree-planting and nature-conservation activities.
Students (kindergarten–senior secondary)	Better environmental disposition observed in the two faith-based foundation schools than in general schools; general awareness that littering is wrong, but practised due to scarce waste bins; collectivist power-relations limit children's ability to influence parental practice (cf. Hofstede, 1980).
Community/religious leaders	Desire for livelihood diversification beyond farming (e.g., small-scale industry); sub-district officials cite need for improved regulation, inter-stakeholder coordination, and monitoring/evaluation; perceived benefit concentration among a small elite; declining influence of religious leaders; budgets allocated without adequate needs mapping; programme discontinuity; limited full-time human resources for implementation; fragmented (non-holistic) programme design; feeling of exclusion from planning; unmanaged/unfair irrigation-water allocation.
Youth / environmental-group leaders	Inadequate waste-management facilities; insufficient funding for waste-processing activities; assistance programmes whose benefits are not felt by the community due to weak oversight.
Livestock farmers	Long-standing government neglect; limited land availability driving settlement and manure disposal near the river; manure-to-compost processing perceived as too slow/inconvenient to adopt; anxiety over livestock loss motivating proximity of animal housing to the home; assistance programmes rarely reach this group.
Crop farmers	Gender-based wage disparity (female farm labourers earn roughly 50% of male wages); no perceived alternative livelihood; concern that switching to coffee cultivation (longer harvest cycle) would jeopardise daily income without wage support during the transition; unmonitored, inequitable water allocation during the dry season; landowner–labourer tension.

4.6 Cross-Cutting Community Priority Issues

Synthesising across all six community elements, eleven recurring priority issues emerged as most salient to respondents: (1) inadequate final waste-disposal sites and management systems; (2) unmonitored, inequitable dry-season water allocation; (3) community distrust directed at both government officials and certain community members perceived to worsen environmental degradation; (4) broader institutional distrust of government; (5) government emphasis on physical rather than behavioural/mental programming; (6) ineffective, largely one-directional ("top-down") socialisation of the Citarum Harum programme; (7) lack of programme consistency, monitoring, and evaluation ("one-shot," "hit-and-run" implementation); (8) unclear livelihood-transition (alih profesi) programming; (9) a persistent mindset that schooling is merely a pre-marriage interlude; (10) insufficient planting-distance tolerance between coffee and vegetable crops; and (11) absence of adequate, organised livestock-waste disposal and treatment facilities.

Discussion

5.1 A Structural, Not Localised, Problem

The central quantitative finding of this study—that environmental-care behaviour among students does not differ significantly across Cihawuk, Cibeureum, Tarumajaya, and Cikembang (Kruskal-Wallis $p = 0.992$; all pairwise Mann-Whitney $p > 0.05$)—carries a clear policy implication. Despite variation in population size, cattle density, dominant parental occupation, and school-of-origin composition (Tables 1–6), the four villages exhibit a statistically indistinguishable behavioural profile, with roughly three in five students scoring in the "Disagree"/"Strongly Disagree" range on environmental-care items. This homogeneity, corroborated by the qualitative convergence of near-identical stakeholder concerns across villages (Table 10), suggests that the drivers of poor environmental behaviour in the upper Citarum are structural and systemic—rooted in shared infrastructural deficits, curricular gaps, and institutional dynamics—rather than localised cultural variation specific to any one village. This has a direct design implication for the Citarum Harum programme and future KLHK rehabilitation planning: a coordinated, subdistrict-wide behavioural and institutional intervention is likely to be more efficient than village-by-village tailored micro-interventions, consistent with recent calls for multi-stakeholder, collaborative watershed governance in the Citarum basin (Abdillah et al., 2024; Hadfield et al., 2024), although infrastructure investment (e.g., manure-processing capacity) should still be scaled to each village's specific waste and livestock burden (Tables 5–6).



Figure 5. Community Service Excecution

5.2 The Attitude–Behaviour Gap Under Infrastructural Constraint

The item-level pattern described in Section 4.3—strong normative rejection of littering and open defecation in principle, coexisting with tolerant or neutral scores on infrastructure-constrained practices such as sweeping classroom dirt into the river—is consistent with Kollmuss and Agyeman's (2002) attitude–behaviour gap and with Ajzen's (1991) emphasis on perceived behavioural control as a determinant of actual behaviour, independent of attitude. Where waste bins and sanitation facilities are scarce, as repeatedly reported by youth, community leaders, and educators (Table 10), pro-environmental attitudes cannot reliably translate into pro-environmental practice (Stern, 2000; Vaske & Kobrin, 2001). This reframes the policy problem: educational messaging alone, without commensurate investment in accessible waste and sanitation infrastructure, is unlikely to close the attitude–behaviour gap identified in this study, a pattern that parallels documented river-sanitation behaviour elsewhere in rural Indonesia where infrastructure and social norms, rather than attitude alone, predict open-defecation practice (Odagiri et al., 2017).

5.3 Cultural Transmission and the Limits of School-Based Intervention

Consistent with Hofstede's (1980) characterisation of Indonesian society as collectivist and authority-oriented, interview data indicate that students' capacity to transmit environmental knowledge to their households is constrained

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by prevailing power relations between children and adults. This finding cautions against an exclusively school-curriculum-based theory of change: because parents, farmers, and livestock keepers hold greater authority within the household and community, sustained behaviour change likely requires parallel engagement of adult authority figures—religious leaders, village officials, and farmer/livestock-group leaders—rather than relying solely on a "trickle-up" effect from children to parents, an effect that is reported in some intergenerational environmental-education studies (Damerell et al., 2013; Husin et al., 2025) but is not guaranteed, particularly where social learning is shaped by peer and authority modelling rather than formal instruction alone (Bandura, 1977). The two faith-based school foundations that had voluntarily integrated conservation activities into their local-content curriculum (Table 10) offer a plausible model: their association with respected religious authority may partially explain the qualitatively better environmental disposition reported for their students, though this study's quantitative sample was not sufficiently powered to test this comparison statistically.

5.4 Institutional Trust and Programme Discontinuity

Qualitative findings across community and religious leaders, youth, and farmer groups converge on themes of institutional distrust, perceived benefit concentration among a small elite, top-down ("military-style") communication, and a repeated "one-shot" pattern of programme implementation without monitoring or evaluation. This pattern helps explain why more than two decades of high-cost interventions—including the Rp 6.7 trillion ICWRMIP loan—have not produced durable behavioural or environmental change: physical investment without accompanying institutional trust-building and continuous monitoring appears structurally prone to the same discontinuity that undermined Citarum Bergetar, ICWRMIP, and Citarum Bestari. This underscores the value of establishing an empirical behavioural and institutional baseline, as attempted here, before further large-scale investment under Citarum Harum, so that programme effectiveness can be tracked against a defined starting point rather than assumed—an approach consistent with recent recommendations for participatory, trust-building watershed governance in the Citarum basin (Abdillah et al., 2024; Hadfield et al., 2024).

5.5 Policy Implications

Based on the combined quantitative and qualitative evidence, four cross-cutting policy domains are proposed, consistent with a "Mental Revolution" framing that treats behavioural and institutional change as prerequisite to, not merely accompanying, physical rehabilitation:

Education: integrate environmental-conservation content into local-content (muatan lokal) curricula across all schools, not only the two faith-based foundations currently doing so voluntarily; provide teacher training in participatory environmental pedagogy; and formally link schools with village heads, sub-district officials, religious leaders, and farmer/livestock-group leaders to coordinate synchronized "model green village" initiatives.

Culture: engage religious and traditional authority figures directly as environmental-behaviour messengers, leveraging the collectivist, authority-respecting social structure identified in Section 5.3, rather than relying solely on school-based transmission.

Social: establish continuous, bidirectional (not top-down) communication and participatory planning mechanisms between government, community leaders, and residents, alongside independent monitoring and evaluation of programme benefit distribution to rebuild institutional trust.

Economic: invest in accessible waste and livestock-manure processing infrastructure scaled to each village's estimated burden (Tables 5–6); support fair, monitored dry-season irrigation-water allocation; and design livelihood-diversification and crop-transition programmes (e.g., coffee cultivation) with interim income support to address farmers' and farm labourers' documented economic anxieties.



Figure 6. FGD with a group of farmers and livestock breeders in the Citawa and Cibeureum areas.

CONCLUSION

This study provides an empirical, multi-element baseline of environmental perception and behaviour in the four uppermost villages of the Citarum watershed. Three principal conclusions emerge. First, students' environmental-care behaviour is statistically indistinguishable across Cihawuk, Cibeureum, Tarumajaya, and Cikembang (Kruskal-Wallis $p = 0.992$), indicating that upstream Citarum pollution reflects shared structural and institutional conditions rather than village-specific cultural variation. Second, a clear attitude–behaviour gap exists: students strongly reject pollutive practices in principle but tolerate or normalise them where sanitation and waste infrastructure is absent, consistent with established environmental-behaviour theory. Third, qualitative evidence from six community elements converges on a consistent set of structural barriers—curricular gaps, infrastructural deficits, institutional distrust, and discontinuous, poorly monitored past programming—that have limited the effectiveness of more than two decades of rehabilitation investment.

Accordingly, this study recommends a coordinated, behaviour-centred rehabilitation strategy organised around four domains: (1) Education—systematic integration of environmental content into local-content curricula, supported by teacher training and cross-institutional coordination; (2) Culture—active engagement of religious and community authority figures as behaviour-change messengers; (3) Social—participatory, bidirectional planning and independent monitoring/evaluation mechanisms to rebuild institutional trust; and (4) Economic—infrastructure investment scaled to each village's documented waste and livestock burden, fair water governance, and livelihood-transition support with interim income protection. These recommendations are directly relevant to the ongoing Citarum Harum programme and to KLHK's continuing watershed rehabilitation and reforestation efforts, and are intended to complement—rather than substitute for—physical infrastructure investment already underway.

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