**Supplementary Material: Detailed Table**

Table S1. Confusion Matrix and Accuracy Assessment of Land Use Classification 2019

|  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Class** | WATR | FRST | ORCD | URBN | AGRL | RICE | **Total** | **U-Accuracy** | **Kappa** |
| WATR | 1 | 0 | 0 | 0 | 0 | 0 | 1 | 1 | 0 |
| FRST | 0 | 53 | 2 | 0 | 0 | 2 | 57 | 1 | 0 |
| ORCD | 0 | 0 | 12 | 0 | 0 | 1 | 13 | 1 | 0 |
| URBN | 0 | 0 | 0 | 10 | 2 | 1 | 13 | 1 | 0 |
| AGRL | 0 | 0 | 0 | 0 | 6 | 1 | 7 | 1 | 0 |
| RICE | 0 | 0 | 0 | 0 | 1 | 8 | 9 | 1 | 0 |
| **Total** | 1 | 53 | 14 | 10 | 9 | 13 | 100 | 0 | 0 |
| **P-Accuracy** | 1.000 | 1.000 | 0.857 | 1.000 | 0.667 | 0.615 | 0.000 | 0.900 | 0.000 |
| **Kappa** | 0.866 |

Detailed classification results of supervised classification using Landsat 8 imagery in 2019, including user accuracy, producer accuracy, and kappa coefficient.

Table S2. Confusion Matrix and Accuracy Assessment of Land Use Classification in 2024

| **Class** | WATR | URBN | AGRL | FRST | RICE | ORCD | **Total** | **U-Accuracy** | **Kappa** |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| WATR | 1 | 0 | 0 | 0 | 0 | 0 | 1 | 1 | 0 |
| URBN | 1 | 12 | 1 | 0 | 0 | 0 | 14 | 1 | 0 |
| AGRL | 0 | 0 | 14 | 0 | 0 | 1 | 15 | 1 | 0 |
| FRST | 0 | 0 | 1 | 36 | 1 | 1 | 39 | 1 | 0 |
| RICE | 0 | 0 | 0 | 0 | 14 | 1 | 15 | 1 | 0 |
| ORCD | 0 | 0 | 0 | 2 | 0 | 14 | 16 | 1 | 0 |
| **Total** | 2 | 12 | 16 | 38 | 15 | 17 | 100 | 0 | 0 |
| **P-Accuracy** | 0.500 | 1.000 | 0.875 | 0.947 | 0.933 | 0.824 | 0.000 | 0.910 | 0.000 |
| **Kappa** | 0.882 |

Classification accuracy results for 2024, highlighting agreement between classified maps and reference data.

Table S3. Suspended Load Calculation Results

|  |  |  |  |
| --- | --- | --- | --- |
| **Point** | **C (mg/l)** | **Qw (m3/s)** | **Qs** |
| **ton/day** | **ton/year** | **m3/year** |
| 1 | 147 | 2.85 | 36.18 | 13207.37 | 8804.91 |
| 2 | 297 | 7.55 | 193.64 | 70677.28 | 47118.19 |
| 3 | 174 | 4.54 | 68.30 | 24928.64 | 16619.09 |
| **Total** | **298.12** | **108813.30** | **72542.20** |

Instantaneous method results of suspended sediment transport across three sampling points in the Kreo River.

Table S4. Bed Load Calculation Results

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Point** | **qb****(ton/year)** | **qs****(ton/year)** | **Total load****(ton/year)** | **Total load****(m3/year)** |
| 1 | 2.95 | 0.30 | 3.25 | 2.17 |
| 2 | 3.92 | 0.39 | 4.32 | 2.88 |
| 3 | 3.22 | 0.32 | 3.55 | 2.36 |
| **Total** | **11.109** | **7.41** |

Calculated bed load transport using Meyer-Peter-Müller method at three sampling points.

Table S5. Total Load Calculation (Suspended + Bed Load)

|  |  |  |  |
| --- | --- | --- | --- |
| **Point** | **Suspended Load** | **Bed Load** | **Total Load** |
| **m3/year** | **m3/year** | **m3/year** |
| 1 | 8804.91 | 2.17 | 8807.08 |
| 2 | 47118.19 | 2.88 | 47121.07 |
| 3 | 16619.09 | 2.36 | 16621.46 |
| **Total** | **72542.20** | **7.41** | **72549.60** |

Combined sediment load results showing contribution of suspended and bed load.

Table S6. Erosion Hazard Index Calculations for 2019

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| **Sub-Basin** | **Area (Ha)** | **Erosion (ton/ha/yr)** | **Tolerable Soil Loss** | **Erosion Hazard Index** | **Criticality** | **Erosion Hazrd Index Category** |
|
| 1 | 2865.0 | 35.87 | 16 | 2.2 | Semi-Critical | Moderate |
| 2 | 184.0 | 20.33 | 16 | 1.3 | Semi-Critical | Moderate |
| 3 | 639.0 | 14.34 | 16 | 0.9 | Potentially Critical | Low |
| 4 | 360.0 | 19.37 | 16 | 1.2 | Semi-Critical | Moderate |
| 5 | 484.0 | 18.37 | 16 | 1.1 | Semi-Critical | Moderate |
| 6 | 171.0 | 22.21 | 16 | 1.4 | Semi-Critical | Moderate |
| 7 | 362.0 | 25.25 | 16 | 1.6 | Semi-Critical | Moderate |

Detailed sub-watershed level erosion index changes in 2019. Erosion Hazard Index is classified into two categories: low and moderate, with the moderate category dominating 87.4% of the total area, highlighting the vulnerability of the landscape due to reduced vegetation cover and increasing land use pressures. These findings underscore the need for early conservation efforts even in 2019

Table S7. Erosion Hazard Index Calculations for 2024

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| **Sub-Basin** | **Area (Ha)** | **Erosion (ton/ha/yr)** | **Tolerable Soil Loss** | **Erosion Hazard Index** | **Criticality** | **Erosion Hazard Index Category** |
|
| 1 | 2865.0 | 127,36 | 16 | 7,960 | Critical | High |
| 2 | 184.0 | 91,72 | 16 | 5,733 | Critical | High |
| 3 | 639.0 | 98,70 | 16 | 6,169 | Critical | High |
| 4 | 360.0 | 105,16 | 16 | 6,573 | Critical | High |
| 5 | 484.0 | 105,48 | 16 | 6,593 | Critical | High |
| 6 | 171.0 | 120,27 | 16 | 7,517 | Critical | High |
| 7 | 362.0 | 107,27 | 16 | 6,704 | Critical | High |

Erosion Hazard Index is classified into only one category: high, reflecting the compounded effects of forest loss, urban expansion, and agricultural intensification. This marked shift highlights a worsening trend of land degradation that requires urgent and targeted watershed management.

Table S8. Erosion Hazard Index Calculations for 2019

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| **Sub-Basin** | **Area (Ha)** | **Erosion (ton/ha/yr)** | **Tolerable Soil Loss** | **Erosion Hazard Index** | **Criticality** | **Erosion Hazard Index Category** |
|  |
| 1 | 2865.0 | 56,91 | 16 | 3,56 | Semi-Critical | Moderate |  |
| 2 | 184.0 | 42,19 | 16 | 2,11 | Semi Critical | Moderate |  |
| 3 | 639.0 | 43,89 | 16 | 2,74 | Critical | Moderate |  |
| 4 | 360.0 | 15,77 | 16 | 0,99 | Potential Critical | Low |  |
| 5 | 484.0 | 73,42 | 16 | 4,59 | Critical | High |  |
| 6 | 171.0 | 41,47 | 16 | 2,07 | Semi-Critical | Moderate |  |
| 7 | 362.0 | 31,07 | 16 | 1,94 | Semi-Critical | Moderate |  |

Following the implementation of the conservation-based land use simulation, the IBE values showed considerable improvement across the watershed. Erosion Harzard Index after conservation resulting in total 9.56% of the area has a “high” IBE category, followed by a “moderate” category of 83.34%, and a low category with 7.11% of the total area. This reduction is primarily attributed to increased vegetation cover, which enhances soil cohesion and infiltration capacity, thereby decreasing surface runoff and erosion potential.