

## Supplementary Material

### Supplementary Tables

**Table S1.** Detailed characteristics of the study watersheds.

Characteristics (unit)	Aba Gerima	
Watershed	Kecha	Laguna
Area (ha)	395.32	339.42
Elevation (m.a.s.l.)	1913.95–2121.99	1946.52–2252.63
Slope range, mean (°)	0.02–41.51, 8.04	0.04–53.04, 14.51
Drainage density (km km <sup>-2</sup> ) <sup>a</sup>	5.38	4.59
Major soil types <sup>b</sup>	Luvisols, Regosols	Regosols, Leptosols
Major land use/land cover	Cultivated land	Cultivated land
SWC practice <sup>c</sup>	Treated	Untreated
Agro-ecology	Midland	
Mean annual rainfall (mm)	1343	
Mean daily temperature (°C)	17–31	
Climate	Moist <i>Weyna Dega</i> <sup>d</sup>	
Major crops	Teff, finger millet, wheat, maize	
Rainfall erosivity	Very high	
Major soil texture class <sup>b</sup>	Clay	
Soil bulk density (g cm <sup>-3</sup> ) <sup>b</sup>	1.21–1.40	
Average soil penetration resistance (kPa) <sup>e</sup>	2200	

Note: Teff (*Eragrostis tef*); finger millet (*Eleusine coracana*); wheat (*Triticum aestivum*); maize (*Zea mays*).

<sup>a</sup> Setargie et al. [17]; <sup>b</sup> Mekonnen [16]; <sup>c</sup> Berihun et al. [32]; <sup>d</sup> Hurni et al. [35].

<sup>e</sup> SWC: soil and water conservation practices (Kecha received high governmental and non-governmental SWC programs since 2011; Laguna has no SWC practices).

**Table S2.** Land use/land cover changes between 2005 and 2021 in Kecha and Laguna watersheds.

LULC	Kecha						Laguna					
	2005		2021		Change (2005–2021)		2005		2021		Change (2005–2021)	
	Area (ha)	Area (%)	Area (ha)	Area (%)	Area (ha)	Area (%)	Area (ha)	Area (%)	Area (ha)	Area (%)	Area (ha)	Area (%)
BL	37.29	9.43	21.38	5.40	15.91	4.02	57.33	16.89	50.17	14.78	7.16	2.11
CL	272.34	68.83	281.97	71.24	-9.63	-2.40	219.14	64.56	205.29	60.47	13.85	4.09
FL	32.69	8.26	39.13	9.89	-6.44	-1.62	42.72	12.59	43.80	12.90	-1.08	-0.32
GL	50.98	12.88	37.74	9.53	13.24	3.35	18.03	5.31	23.56	6.94	-5.53	-1.63
KP	1.79	0.45	13.10	3.31	-11.31	-2.86	1.66	0.49	11.96	3.52	-10.30	-3.03
ST	0.56	0.14	2.51	0.63	-1.94	-0.49	0.55	0.16	4.69	1.38	-4.15	-1.22

LULC: land use/land cover; BL: bushland; CL: cultivated land; FL: forest land; GL: grazing land; KP: khat plantation; ST: settlements.

**Table S3.** Major soil types in Kecha and Laguna watersheds.

Soil type	Kecha		Soil type	Laguna	
	Area (ha)	Area (%)		Area (ha)	Area (%)
Cambic Cambisols	0.63	0.16	Cambic Cambisols	59.02	17.39
Chromic Cambisols	0.69	0.17	Chromic Cambisols	48.20	14.20
Eutric Regosols	78.91	19.96	Eutric Regosols	117.85	34.72
Haplic Luvisols	93.29	23.60	Haplic Luvisols	0.04	0.01
Leptosols	2.25	0.57	Leptosols	14.91	4.39
Lithic Leptosols	16.71	4.23	Lithic Leptosols	95.89	28.25
Luvisols	10.43	2.64	Luvisols	3.35	0.99
Nithic Luvisols	191.26	48.38	Nithic Luvisols	0.16	0.05
Vertisols	1.15	0.29			

**Table S4.** The hydrologic-soil-cover complexes and derived runoff curve number-II for Kecha and Laguna watersheds based on Soil Conservation Service (SCS) [38].

(a) For Kecha in 2005

Land use	Cover type	Treatment	Hydrologic condition	Curve number-II			
				HSG A	HSG B	HSG C	HSG D
Cultivated land	Row crops & Small grains	Straight row	Poor	68.5	78.5	86	89.5
Grazing land			Poor	68	79	86	89
Khat plantation			Poor	48	67	77	83
Bushland			Fair	35	56	70	77
Forest land			Fair	43	65	76	82
Settlements			-	76	85	89	91

HSG: hydrologic soil group

(b) For Kecha in 2021

Land use	Cover type	Treatment	Hydrologic condition	Curve number-II			
				HSG A	HSG B	HSG C	HSG D
Cultivated land	Row crops & Small grains	Contoured & Terraced	Good	60.5	70.5	78	81
Grazing land			Fair	49	69	79	84
Khat plantation			Poor	48	67	77	83
Bushland			Good	30	48	65	73
Forest land			Good	32	58	72	79
Settlements			-	76	85	89	91

HSG: hydrologic soil group

(c) For Laguna in 2005

Land use	Cover type	Treatment	Hydrologic condition	Curve number-II			
				HSG A	HSG B	HSG C	HSG D
Cultivated land	Row crops & Small grains	Straight row	Poor	68.5	78.5	86	89.5
Grazing land			Poor	68	79	86	89
Khat plantation			Poor	48	67	77	83
Bushland			Fair	35	56	70	77
Forest land			Fair	43	65	76	82
Settlements			-	76	85	89	91

HSG: hydrologic soil group

(d) For Laguna in 2021

Land use	Cover type	Treatment	Hydrologic condition	Curve number-II			
				HSG A	HSG B	HSG C	HSG D
Cultivated land	Row crops & Small grains	Straight row	Poor	68.5	78.5	86	89.5
Grazing land			Poor	68	79	86	89
Khat plantation			Poor	48	67	77	83
Bushland			Fair	35	56	70	77
Forest land			Fair	43	65	76	82
Settlements			-	76	85	89	91

HSG: hydrologic soil group

**Table S5.** Descriptive statistics of erosion indices for different land use/land cover and rainfall scenarios in Kecha and Laguna watersheds.

Watershed	Scenario		Erosion index ( <i>e</i> )			
	Curve number	Rainfall (mm day <sup>-1</sup> )	Min.	Max.	Mean	St. Dev.
Kecha	CN <sub>2005</sub> (untreated)	10	0.00	0.05	0.00	0.00
		30	0.00	1.37	0.03	0.06
		60	0.00	8.78	0.15	0.29
		100	0.00	28.45	0.35	0.72
	CN <sub>2021</sub> (treated)	10	0.00	0.01	0.00	0.00
		30	0.00	0.24	0.01	0.01
		60	0.00	2.36	0.04	0.07
		100	0.00	12.57	0.12	0.25
Laguna	CN <sub>2005</sub> (untreated)	10	0.00	0.06	0.00	0.00
		30	0.00	2.29	0.05	0.08
		60	0.00	17.44	0.25	0.47
		100	0.00	48.73	0.66	1.32
	CN <sub>2021</sub> (untreated)	10	0.00	0.06	0.00	0.00
		30	0.00	2.25	0.05	0.08
		60	0.00	13.03	0.25	0.46
		100	0.00	53.82	0.67	1.31

CN<sub>2005</sub>: Curve number scenario in 2005; CN<sub>2021</sub>: Curve number scenario in 2021; Min.: minimum; Max.: maximum; St. Dev.: standard deviation.

**Table S6.** Gully-based prediction performance of different erosion indices exceeding critical thresholds.

Watershed	Scenario		$e$	Gully-based performance									
	Curve number	Rainfall (mm day <sup>-1</sup> )		TP	TN	FP	FN	TPR	TNR	FPR	FNR	OA	$\frac{TPR + TNR}{2}$
Kecha	CN <sub>2005</sub>	10	0.01	85	153741	4997	1370	0.058	<b>0.969</b>	0.031	0.942	0.960	<b>0.513</b>
Kecha	CN <sub>2021</sub>	10	0.01	0	158604	4	1584	0.000	<b>1.000</b>	0.000	1.000	0.990	<b>0.500</b>
Laguna	CN <sub>2005</sub>	10	0.01	83	126805	10199	458	0.153	<b>0.926</b>	0.074	0.847	0.923	<b>0.539</b>
Laguna	CN <sub>2005</sub>	10	0.05	0	137000	4	541	0.000	<b>1.000</b>	0.000	1.000	0.996	<b>0.500</b>
Laguna	CN <sub>2021</sub>	10	0.01	143	126408	10060	934	0.133	<b>0.926</b>	0.074	0.867	0.920	<b>0.530</b>
Laguna	CN <sub>2021</sub>	10	0.05	0	136462	6	1077	0.000	<b>1.000</b>	0.000	1.000	0.992	<b>0.500</b>
Kecha	CN <sub>2005</sub>	30	0.01	722	75699	83039	733	<b>0.496</b>	<b>0.477</b>	0.523	0.504	0.477	<b>0.487</b>
Kecha	CN <sub>2005</sub>	30	0.05	411	121921	36817	1044	0.282	<b>0.768</b>	0.232	0.718	0.764	<b>0.525</b>
Kecha	CN <sub>2005</sub>	30	0.1	200	143058	15680	1255	0.137	<b>0.901</b>	0.099	0.863	0.894	<b>0.519</b>
Kecha	CN <sub>2005</sub>	30	0.5	13	158524	214	1442	0.009	<b>0.999</b>	0.001	0.991	0.990	<b>0.504</b>
Kecha	CN <sub>2005</sub>	30	1	1	158730	8	1454	0.001	<b>1.000</b>	0.000	0.999	0.991	<b>0.500</b>
Kecha	CN <sub>2021</sub>	30	0.01	594	114581	44027	990	0.375	<b>0.722</b>	0.278	0.625	0.719	<b>0.549</b>
Kecha	CN <sub>2021</sub>	30	0.05	43	157503	1105	1541	0.027	<b>0.993</b>	0.007	0.973	0.983	<b>0.510</b>
Kecha	CN <sub>2021</sub>	30	0.1	7	158514	94	1577	0.004	<b>0.999</b>	0.001	0.996	0.990	<b>0.502</b>
Laguna	CN <sub>2005</sub>	30	0.01	339	54900	82104	202	<b>0.627</b>	<b>0.401</b>	0.599	0.373	0.402	<b>0.514</b>
Laguna	CN <sub>2005</sub>	30	0.05	241	92303	44701	300	<b>0.445</b>	<b>0.674</b>	0.326	0.555	0.673	<b>0.560</b>
Laguna	CN <sub>2005</sub>	30	0.1	142	113812	23192	399	0.262	<b>0.831</b>	0.169	0.738	0.828	<b>0.547</b>
Laguna	CN <sub>2005</sub>	30	0.5	7	136352	652	534	0.013	<b>0.995</b>	0.005	0.987	0.991	<b>0.504</b>
Laguna	CN <sub>2005</sub>	30	1	0	136937	67	541	0.000	<b>1.000</b>	0.000	1.000	0.996	<b>0.500</b>
Laguna	CN <sub>2021</sub>	30	0.01	650	54123	82345	427	<b>0.604</b>	0.397	0.603	0.396	0.398	<b>0.500</b>
Laguna	CN <sub>2021</sub>	30	0.05	452	91244	45224	625	<b>0.420</b>	<b>0.669</b>	0.331	0.580	0.667	<b>0.544</b>
Laguna	CN <sub>2021</sub>	30	0.1	265	113014	23454	812	0.246	<b>0.828</b>	0.172	0.754	0.824	<b>0.537</b>
Laguna	CN <sub>2021</sub>	30	0.5	12	135895	573	1065	0.011	<b>0.996</b>	0.004	0.989	0.988	<b>0.503</b>
Laguna	CN <sub>2021</sub>	30	1	0	136393	75	1077	0.000	<b>0.999</b>	0.001	1.000	0.992	<b>0.500</b>

Kecha	CN <sub>2005</sub>	60	0.01	810	63494	95244	645	0.557	0.400	0.600	0.443	0.401	0.478
Kecha	CN <sub>2005</sub>	60	0.05	810	64313	944425	645	0.557	0.064	0.936	0.443	0.064	0.310
Kecha	CN <sub>2005</sub>	60	0.1	555	101665	57073	900	0.381	0.640	0.360	0.619	0.638	0.511
Kecha	CN <sub>2005</sub>	60	0.5	150	146948	11790	1305	0.103	0.926	0.074	0.897	0.918	0.514
Kecha	CN <sub>2005</sub>	60	1	58	155790	2948	1397	0.040	0.981	0.019	0.960	0.973	0.511
Kecha	CN <sub>2005</sub>	60	5	1	158716	22	1454	0.001	1.000	0.000	0.999	0.991	0.500
Kecha	CN <sub>2021</sub>	60	0.01	874	63659	94949	710	0.552	0.401	0.599	0.448	0.403	0.477
Kecha	CN <sub>2021</sub>	60	0.05	872	66032	92576	712	0.551	0.416	0.584	0.449	0.418	0.483
Kecha	CN <sub>2021</sub>	60	0.1	295	140147	18461	1289	0.186	0.884	0.116	0.814	0.877	0.535
Kecha	CN <sub>2021</sub>	60	0.5	15	158210	398	1569	0.009	0.997	0.003	0.991	0.988	0.503
Kecha	CN <sub>2021</sub>	60	1	2	158562	46	1582	0.001	1.000	0.000	0.999	0.990	0.500
Laguna	CN <sub>2005</sub>	60	0.01	346	40155	96849	195	0.640	0.293	0.707	0.360	0.294	0.466
Laguna	CN <sub>2005</sub>	60	0.05	346	40567	96437	195	0.640	0.296	0.704	0.360	0.297	0.468
Laguna	CN <sub>2005</sub>	60	0.1	296	70714	66290	245	0.547	0.516	0.484	0.453	0.516	0.532
Laguna	CN <sub>2005</sub>	60	0.5	110	116794	20210	431	0.203	0.852	0.148	0.797	0.850	0.528
Laguna	CN <sub>2005</sub>	60	1	34	130367	6637	507	0.063	0.952	0.048	0.937	0.948	0.507
Laguna	CN <sub>2005</sub>	60	5	2	136844	160	539	0.004	0.999	0.001	0.996	0.995	0.501
Laguna	CN <sub>2005</sub>	60	10	0	136991	13	541	0.000	1.000	0.000	1.000	0.996	0.500
Laguna	CN <sub>2021</sub>	60	0.01	669	39937	96531	408	0.621	0.293	0.707	0.379	0.295	0.457
Laguna	CN <sub>2021</sub>	60	0.05	669	40363	96105	408	0.621	0.296	0.704	0.379	0.298	0.458
Laguna	CN <sub>2021</sub>	60	0.1	567	69335	67133	510	0.526	0.508	0.492	0.474	0.508	0.517
Laguna	CN <sub>2021</sub>	60	0.5	209	115935	20533	868	0.194	0.850	0.150	0.806	0.844	0.522
Laguna	CN <sub>2021</sub>	60	1	76	129868	6600	1001	0.071	0.952	0.048	0.929	0.945	0.511
Laguna	CN <sub>2021</sub>	60	5	2	136327	141	1075	0.002	0.999	0.001	0.998	0.991	0.500
Laguna	CN <sub>2021</sub>	60	10	0	136461	7	1077	0.000	1.000	0.000	1.000	0.992	0.500
Kecha	CN <sub>2005</sub>	100	0.01	810	63487	95251	645	0.557	0.400	0.600	0.443	0.401	0.478
Kecha	CN <sub>2005</sub>	100	0.05	810	63537	95201	645	0.557	0.400	0.600	0.443	0.402	0.478
Kecha	CN <sub>2005</sub>	100	0.1	720	78446	80292	735	0.495	0.494	0.506	0.505	0.494	0.495



Kecha	CN <sub>2005</sub>	100	0.5	335	126895	31843	1120	0.230	<b>0.799</b>	0.201	0.770	0.794	<b>0.515</b>
Kecha	CN <sub>2005</sub>	100	1	176	143669	15069	1279	0.121	<b>0.905</b>	0.095	0.879	0.898	<b>0.513</b>
Kecha	CN <sub>2005</sub>	100	5	18	158236	502	1437	0.012	<b>0.997</b>	0.003	0.988	0.988	<b>0.505</b>
Kecha	CN <sub>2005</sub>	100	10	3	158677	61	1452	0.002	<b>1.000</b>	0.000	0.998	0.991	<b>0.501</b>
Kecha	CN <sub>2021</sub>	100	0.01	874	63430	95178	710	<b>0.552</b>	0.400	0.600	0.448	0.401	<b>0.476</b>
Kecha	CN <sub>2021</sub>	100	0.05	873	63802	94806	711	<b>0.551</b>	<b>0.402</b>	0.598	0.449	0.404	<b>0.477</b>
Kecha	CN <sub>2021</sub>	100	0.1	612	106244	52364	972	0.386	<b>0.670</b>	0.330	0.614	0.667	<b>0.528</b>
Kecha	CN <sub>2021</sub>	100	0.5	139	150209	8399	1445	0.088	<b>0.947</b>	0.053	0.912	0.939	<b>0.517</b>
Kecha	CN <sub>2021</sub>	100	1	48	156781	1827	1536	0.030	<b>0.988</b>	0.012	0.970	0.979	<b>0.509</b>
Kecha	CN <sub>2021</sub>	100	5	0	158574	34	1584	0.000	<b>1.000</b>	0.000	1.000	0.990	<b>0.500</b>
Kecha	CN <sub>2021</sub>	100	10	0	158606	2	1584	0.000	<b>1.000</b>	0.000	1.000	0.990	<b>0.500</b>
Laguna	CN <sub>2005</sub>	100	0.01	346	40132	96872	195	<b>0.640</b>	0.293	0.707	0.360	0.294	<b>0.466</b>
Laguna	CN <sub>2005</sub>	100	0.05	346	40196	96808	195	<b>0.640</b>	0.293	0.707	0.360	0.295	<b>0.466</b>
Laguna	CN <sub>2005</sub>	100	0.1	338	47872	89132	203	<b>0.625</b>	0.349	0.651	0.375	0.351	<b>0.487</b>
Laguna	CN <sub>2005</sub>	100	0.5	202	90727	46277	339	0.373	<b>0.662</b>	0.338	0.627	0.661	<b>0.518</b>
Laguna	CN <sub>2005</sub>	100	1	128	110487	26517	413	0.237	<b>0.806</b>	0.194	0.763	0.804	<b>0.522</b>
Laguna	CN <sub>2005</sub>	100	5	8	135131	1873	533	0.015	<b>0.986</b>	0.014	0.985	0.983	<b>0.501</b>
Laguna	CN <sub>2005</sub>	100	10	2	136607	397	539	0.004	<b>0.997</b>	0.003	0.996	0.993	<b>0.500</b>
Laguna	CN <sub>2021</sub>	100	0.01	669	39918	96550	408	<b>0.621</b>	0.293	0.707	0.379	0.295	<b>0.457</b>
Laguna	CN <sub>2021</sub>	100	0.05	669	39970	96498	408	<b>0.621</b>	0.293	0.707	0.379	0.295	<b>0.457</b>
Laguna	CN <sub>2021</sub>	100	0.1	646	47954	88514	431	<b>0.600</b>	0.351	0.649	0.400	0.353	<b>0.476</b>
Laguna	CN <sub>2021</sub>	100	0.5	377	89221	47247	700	0.350	<b>0.654</b>	0.346	0.650	0.651	<b>0.502</b>
Laguna	CN <sub>2021</sub>	100	1	236	109028	27440	841	0.219	<b>0.799</b>	0.201	0.781	0.794	<b>0.509</b>
Laguna	CN <sub>2021</sub>	100	5	21	134710	1758	1056	0.019	<b>0.987</b>	0.013	0.981	0.980	<b>0.503</b>
Laguna	CN <sub>2021</sub>	100	10	2	136093	375	1075	0.002	<b>0.997</b>	0.003	0.998	0.989	<b>0.500</b>

CN<sub>2005</sub>: Curve number scenario in 2005; CN<sub>2021</sub>: Curve number scenario in 2021; *e*: Erosion index; TP: True positive; TN: True negative; FP: False positive; FN: False negative; TPR: True positive rate; TNR: True negative rate; FPR: False positive rate; FNR: False negative rate; OA: Overall accuracy.

Note: Values in bold red, yellow, and green colors indicate prediction performances between 0.4 and 0.45, 0.45 and 0.5, and greater than 0.5, respectively, while the green, yellow, and orange highlighted rows showed the best predictions in decreasing order achieved by a specific erosion index threshold.

**Table S7.** Gully head-based prediction performance of different erosion indices exceeding critical thresholds.

Watershed	Scenario		$e$	Gully head-based performance									
	Curve number	Rainfall (mm day <sup>-1</sup> )		TP	TN	FP	FN	TPR	TNR	FPR	FNR	OA	$\frac{TPR + TNR}{2}$
Kecha	CN <sub>2005</sub>	10	0.01	0	155078	5082	33	0.000	0.968	0.032	1.000	0.968	0.484
Kecha	CN <sub>2021</sub>	10	0.01	0	160148	4	40	0.000	1.000	0.000	1.000	1.000	0.500
Laguna	CN <sub>2005</sub>	10	0.01	3	127253	10279	10	0.231	0.925	0.075	0.769	0.925	0.578
Laguna	CN <sub>2005</sub>	10	0.05	0	137528	4	13	0.000	1.000	0.000	1.000	1.000	0.500
Laguna	CN <sub>2021</sub>	10	0.01	3	127320	10200	22	0.120	0.926	0.074	0.880	0.926	0.523
Laguna	CN <sub>2021</sub>	10	0.05	0	137514	6	25	0.000	1.000	0.000	1.000	1.000	0.500
Kecha	CN <sub>2005</sub>	30	0.01	26	76425	83735	7	0.788	0.477	0.523	0.212	0.477	0.633
Kecha	CN <sub>2005</sub>	30	0.05	14	122946	37214	19	0.424	0.768	0.232	0.576	0.768	0.596
Kecha	CN <sub>2005</sub>	30	0.1	9	144289	15871	24	0.273	0.901	0.099	0.727	0.901	0.587
Kecha	CN <sub>2005</sub>	30	0.5	1	159934	226	32	0.030	0.999	0.001	0.970	0.998	0.514
Kecha	CN <sub>2005</sub>	30	1	0	160151	9	33	0.000	1.000	0.000	1.000	1.000	0.500
Kecha	CN <sub>2021</sub>	30	0.01	18	115549	44603	22	0.450	0.721	0.279	0.550	0.721	0.586
Kecha	CN <sub>2021</sub>	30	0.05	1	159005	1147	39	0.025	0.993	0.007	0.975	0.993	0.509
Kecha	CN <sub>2021</sub>	30	0.1	0	160051	101	40	0.000	0.999	0.001	1.000	0.999	0.500
Laguna	CN <sub>2005</sub>	30	0.01	11	55100	82432	2	0.846	0.401	0.599	0.154	0.401	0.623
Laguna	CN <sub>2005</sub>	30	0.05	9	92599	44933	4	0.692	0.673	0.327	0.308	0.673	0.683
Laguna	CN <sub>2005</sub>	30	0.1	4	114202	23330	9	0.308	0.830	0.170	0.692	0.830	0.569
Laguna	CN <sub>2005</sub>	30	0.5	0	136873	659	13	0.000	0.995	0.005	1.000	0.995	0.498
Laguna	CN <sub>2005</sub>	30	1	0	137465	67	13	0.000	1.000	0.000	1.000	0.999	0.500
Laguna	CN <sub>2021</sub>	30	0.01	19	54544	82976	6	0.760	0.397	0.603	0.240	0.397	0.578
Laguna	CN <sub>2021</sub>	30	0.05	11	91855	45665	14	0.440	0.668	0.332	0.560	0.668	0.554
Laguna	CN <sub>2021</sub>	30	0.1	4	113805	23715	21	0.160	0.828	0.172	0.840	0.827	0.494
Laguna	CN <sub>2021</sub>	30	0.5	0	136935	585	25	0.000	0.996	0.004	1.000	0.996	0.498
Laguna	CN <sub>2021</sub>	30	1	0	137445	75	25	0.000	0.999	0.001	1.000	0.999	0.500

Kecha	CN <sub>2005</sub>	60	0.01	28	64134	96026	5	0.848	0.400	0.600	0.152	0.401	0.624
Kecha	CN <sub>2005</sub>	60	0.05	28	64953	95207	5	0.848	0.406	0.594	0.152	0.406	0.627
Kecha	CN <sub>2005</sub>	60	0.1	18	102550	57610	15	0.545	0.640	0.360	0.455	0.640	0.593
Kecha	CN <sub>2005</sub>	60	0.5	7	148227	11933	26	0.212	0.925	0.075	0.788	0.925	0.569
Kecha	CN <sub>2005</sub>	60	1	2	157156	3004	31	0.061	0.981	0.019	0.939	0.981	0.521
Kecha	CN <sub>2005</sub>	60	5	0	160137	23	33	0.000	1.000	0.000	1.000	1.000	0.500
Kecha	CN <sub>2021</sub>	60	0.01	30	64359	95793	10	0.750	0.402	0.598	0.250	0.402	0.576
Kecha	CN <sub>2021</sub>	60	0.05	30	66734	93418	10	0.750	0.417	0.583	0.250	0.417	0.583
Kecha	CN <sub>2021</sub>	60	0.1	12	141408	18744	28	0.300	0.883	0.117	0.700	0.883	0.591
Kecha	CN <sub>2021</sub>	60	0.5	1	159740	412	39	0.025	0.997	0.003	0.975	0.997	0.511
Kecha	CN <sub>2021</sub>	60	1	0	160104	48	40	0.000	1.000	0.000	1.000	0.999	0.500
Laguna	CN <sub>2005</sub>	60	0.01	11	40348	97184	2	0.846	0.293	0.707	0.154	0.293	0.570
Laguna	CN <sub>2005</sub>	60	0.05	11	40760	96772	2	0.846	0.296	0.704	0.154	0.296	0.571
Laguna	CN <sub>2005</sub>	60	0.1	10	70956	66576	3	0.769	0.516	0.484	0.231	0.516	0.643
Laguna	CN <sub>2005</sub>	60	0.5	3	117215	20317	10	0.231	0.852	0.148	0.769	0.852	0.542
Laguna	CN <sub>2005</sub>	60	1	1	130862	6670	12	0.077	0.952	0.048	0.923	0.951	0.514
Laguna	CN <sub>2005</sub>	60	5	0	137370	162	13	0.000	0.999	0.001	1.000	0.999	0.499
Laguna	CN <sub>2005</sub>	60	10	0	137519	13	13	0.000	1.000	0.000	1.000	1.000	0.500
Laguna	CN <sub>2021</sub>	60	0.01	19	40339	97181	6	0.760	0.293	0.707	0.240	0.293	0.527
Laguna	CN <sub>2021</sub>	60	0.05	19	40765	96755	6	0.760	0.296	0.704	0.240	0.297	0.528
Laguna	CN <sub>2021</sub>	60	0.1	14	69834	67686	11	0.560	0.508	0.492	0.440	0.508	0.534
Laguna	CN <sub>2021</sub>	60	0.5	4	116782	20738	21	0.160	0.849	0.151	0.840	0.849	0.505
Laguna	CN <sub>2021</sub>	60	1	2	130846	6674	23	0.080	0.951	0.049	0.920	0.951	0.516
Laguna	CN <sub>2021</sub>	60	5	0	137377	143	25	0.000	0.999	0.001	1.000	0.999	0.499
Laguna	CN <sub>2021</sub>	60	10	0	137513	7	25	0.000	1.000	0.000	1.000	1.000	0.500
Kecha	CN <sub>2005</sub>	100	0.01	28	64127	96033	5	0.848	0.400	0.600	0.152	0.400	0.624
Kecha	CN <sub>2005</sub>	100	0.05	28	64177	95983	5	0.848	0.401	0.599	0.152	0.401	0.625
Kecha	CN <sub>2005</sub>	100	0.1	25	79173	80987	8	0.758	0.494	0.506	0.242	0.494	0.626

Kecha	CN <sub>2005</sub>	100	0.5	13	127995	32165	20	0.394	0.799	0.201	0.606	0.799	0.597
Kecha	CN <sub>2005</sub>	100	1	8	144923	15237	25	0.242	0.905	0.095	0.758	0.905	0.574
Kecha	CN <sub>2005</sub>	100	5	1	159641	519	32	0.030	0.997	0.003	0.970	0.997	0.514
Kecha	CN <sub>2005</sub>	100	10	0	160096	64	33	0.000	1.000	0.000	1.000	0.999	0.500
Kecha	CN <sub>2021</sub>	100	0.01	30	64130	96022	10	0.750	0.400	0.600	0.250	0.401	0.575
Kecha	CN <sub>2021</sub>	100	0.05	30	64503	95649	10	0.750	0.403	0.597	0.250	0.403	0.576
Kecha	CN <sub>2021</sub>	100	0.1	21	107197	52955	19	0.525	0.669	0.331	0.475	0.669	0.597
Kecha	CN <sub>2021</sub>	100	0.5	4	151618	8534	36	0.100	0.947	0.053	0.900	0.947	0.523
Kecha	CN <sub>2021</sub>	100	1	2	158279	1873	38	0.050	0.988	0.012	0.950	0.988	0.519
Kecha	CN <sub>2021</sub>	100	5	0	160118	34	40	0.000	1.000	0.000	1.000	1.000	0.500
Kecha	CN <sub>2021</sub>	100	10	0	160150	2	40	0.000	1.000	0.000	1.000	1.000	0.500
Laguna	CN <sub>2005</sub>	100	0.01	11	40325	97207	2	0.846	0.293	0.707	0.154	0.293	0.570
Laguna	CN <sub>2005</sub>	100	0.05	11	40389	97143	2	0.846	0.294	0.706	0.154	0.294	0.570
Laguna	CN <sub>2005</sub>	100	0.1	11	48073	89459	2	0.846	0.350	0.650	0.154	0.350	0.598
Laguna	CN <sub>2005</sub>	100	0.5	7	91060	46472	6	0.538	0.662	0.338	0.462	0.662	0.600
Laguna	CN <sub>2005</sub>	100	1	3	110890	26642	10	0.231	0.806	0.194	0.769	0.806	0.519
Laguna	CN <sub>2005</sub>	100	5	0	135651	1881	13	0.000	0.986	0.014	1.000	0.986	0.493
Laguna	CN <sub>2005</sub>	100	10	0	137133	399	13	0.000	0.997	0.003	1.000	0.997	0.499
Laguna	CN <sub>2021</sub>	100	0.01	19	40320	97200	6	0.760	0.293	0.707	0.240	0.293	0.527
Laguna	CN <sub>2021</sub>	100	0.05	19	40372	97148	6	0.760	0.294	0.706	0.240	0.294	0.527
Laguna	CN <sub>2021</sub>	100	0.1	19	48379	89141	6	0.760	0.352	0.648	0.240	0.352	0.556
Laguna	CN <sub>2021</sub>	100	0.5	10	89906	47614	15	0.400	0.654	0.346	0.600	0.654	0.527
Laguna	CN <sub>2021</sub>	100	1	5	109849	27671	20	0.200	0.799	0.201	0.800	0.799	0.499
Laguna	CN <sub>2021</sub>	100	5	1	135742	1778	24	0.040	0.987	0.013	0.960	0.987	0.514
Laguna	CN <sub>2021</sub>	100	10	0	137143	377	25	0.000	0.997	0.003	1.000	0.997	0.499

CN<sub>2005</sub>: Curve number scenario in 2005; CN<sub>2021</sub>: Curve number scenario in 2021; e: Erosion index; TP: True positive; TN: True negative; FP: False positive; FN: False negative; TPR: True positive rate; TNR: True negative rate; FPR: False positive rate; FNR: False negative rate; OA: Overall accuracy.

Note: Values in bold red, yellow, and green colors indicate prediction performances between 0.4 and 0.45, 0.45 and 0.5, and greater than 0.5, respectively, while the green, yellow, and orange highlighted rows showed the best predictions in decreasing order achieved by a specific erosion index threshold.

**Table S8.** SWAT validated curve number values based on 42 field plot experiments in the Upper Blue Nile basin of Ethiopia for different land use management options [adopted from Berihun et al. [10]].

LULC	LUM options	CN2
Cultivated land	Bund+Grass	r_0.47
Grazing land	Exclosure	r_0.35
Bushland	Trench+Exclosure	r_0.32
Khat plantation	Napier/desmodium	r_0.34

SWAT: Soil and Water Assessment Tool; LULC: land use/land cover; LUM: land use management; CN2: runoff curve number-II

Note: r\_ indicates that the calibrated value in SWAT was multiplied by the reported value during the mathematical operation.